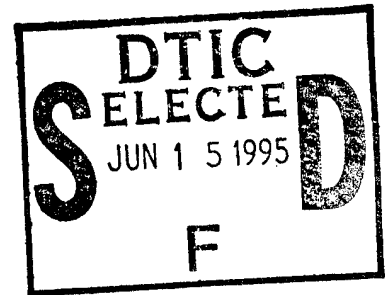




**Remote Tracking Antenna Study  
(TAGGANT)**

**Scientific and Technical Report  
(Final Report)**

Contract #DAAL02-91-C-0091  
CDRL Item #A004



31 December 1992

Prepared for :

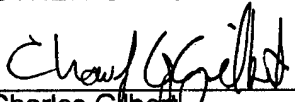
**US Army Harry Diamond Laboratories**  
ATTN: Ron Tobin/John Eicke, SLCHD-TA-TS  
2800 Powder Mill Road  
Adelphi, Maryland 20783-1197

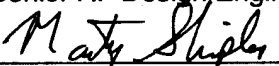
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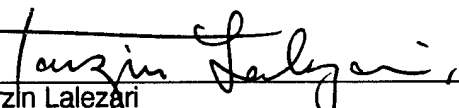
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**Ball Communication Systems Division**  
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Broomfield, Colorado 80021-2510

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DTIC QUALITY INSPECTED 3

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## INTRODUCTION

The final report includes the progress report for the months of October, November and December 1992. The main emphasis remained on packaging and improving the RF performance of an antenna/receiver for Satcom. Additionally, many other type of antennas were investigated. The following antennas were investigated and their data will be discussed in turn (note these are not in chronological order):

1. Letter decal antennas
2. Argos 90 degree bowtie antenna
3. Cellular bow tie antenna
4. Cellular bent monopole antenna
5. Antenna below variable aperture

### 1.0 LETTER DECAL ANTENNAS

A few letters were chosen at random to determine the feasibility of making antennas look like car window decals which actually operate at cellular telephone frequencies. The data in Appendix I looks promising although we simply did not have enough time to fully investigate this.

The three letters we chose were U, W, and N as shown at full scale in **Figure 1**. The VSWR's, antenna patterns and swept gains are shown in Appendix I. Although we chose the letters at random, the letter "L" would have been an important choice as it contains both vertical and horizontal components. Those other letters are somewhat directive (or directional) and have much better polarization isolation than expected. Also, note that this data was taken without the presence of ground planes. The remaining task is to pick a location on an automobile and a decal logo (LSU for example). It is also necessary to engineer ways to hide the feed and optimize the antenna pattern.

### 2.0 ARGOS 90 DEGREE BOWTIE ANTENNA

The Argos application requires an omnidirectional coverage for both polarizations at 401 MHz. Based on experience a 90° bowtie dipole antenna was chosen because of its simplicity and



low profile. Bowtie dipoles with a wide subtended result in both components of polarization. However, as the data in Appendix II shows, the polarization isolation is greater than desired. The full scale photocopy of the artwork of this bowtie antenna is shown in **Figure 2**.

There are two possible solutions to this issue. First of all the angle could be increased to greater than  $90^\circ$ . This would probably produce the desired effects with the exception of the nulls off the ends of the dipole for one polarization. The second option is to use printed cross dipoles which would solve the polarization issue but would still have nulls for one polarization off the ends of the dipoles of the opposite polarization.

### 3.0 CELLULAR BOWTIE ANTENNA

This antenna is a scaled version of the Argos antenna and is shown in **Figure 3**. The center frequency for this antenna is 880 MHz. The data is presented in Appendix III. Results are similar to the Argos antenna. A completely different approach is available as discussed in the following section.

### 4.0 CELLULAR BENT MONOPOLE ANTENNA

This antenna is shown in **Figure 4**. It is relatively low profile and requires only a small ground plane. The coverage of this antenna is very good in one hemisphere as shown in Appendix IV. The best orientation of this antenna is for the circuit board material to be horizontal. This will provide good hemispherical coverage and could be mounted on a car top or in a briefcase or suitcase.

The data shown in Appendix IV is for the antenna sketched in **Figure 4** without any additional ground plane. Also, note that this is a variation of the antenna that BCSD is mass producing for the commercial cellular telephone market.

### 5.0 ANTENNA BELOW VARIABLE APERTURE

In the Satcom band, we were directed (by HDL) to determine the effect of an aperture of variable size on an antenna of known performance. An Archimedean spiral (11 x 15 inch) was chosen as the candidate and tested in the presence of a variable size aperture. The data are presented in Appendix V. The following cases were tested.



Antenna Size	Aperture Size	Depth of Antenna Below GP
11" x 15"	12 x 16 (1" border)	1/8" and 1/2"
11" x 15"	13 x 17 (2" border)	1/8" and 1/2"
11" x 15"	14 x 18 (3" border)	1/8" and 1/2"
11" x 15"	16 x 20 (5" border)	1/8" and 1/2"

As can be seen from this table, for each aperture size the depth of the antenna below this aperture in the 4 ft x 4ft square ground plane was variable between eighth inch and half inch. The results of this test show that the depth below the aperture in the ground plane had little effect compared to the size of the aperture. The larger the aperture the less it disturbed the patterns and gains. The patterns of the antenna without the presence of any aperture are also included in Appendix V.

The gains of the antenna in the presence of the aperture are 2 dB lower for the 1-inch border case and about 0.5 dB lower (as compared to no aperture) for the 5 inch border case. Thus the size of the aperture has a relatively large effect on the performance. The data shows that the depth of the antenna below the aperture has only a minor effect.

## 6.0 REVIEW

This program began with BCSD (per HDL direction) focusing on GPS and cellular telephone antennas to be located beneath a vehicle or in a non-metallic bumper. Standard BCSD GPS antennas were tested at both GPS and GLONASS frequencies with good results (see Appendix I of the October 1991 progress report for complete data). Also bent monopole cellular antennas were built and tested. This included a single element as well a four elements and three element arrays (Appendix II of the October, 1991 progress report and Appendix I November, 1991 progress report respectively). Although suitable GPS and cellular antennas were designed, data on a vehicle was not ever taken as the focus of the program changed.

The focus of this program was shifted to designing and packaging antennas (in particular Satcom antennas) into a portable case. There were a considerable number of configurations built and tested before the final silhouette design evolved (see Appendices I-V of this report). Also, S-band Bifilar and Quadrafilar Helices were investigated for communicating with TDRSS



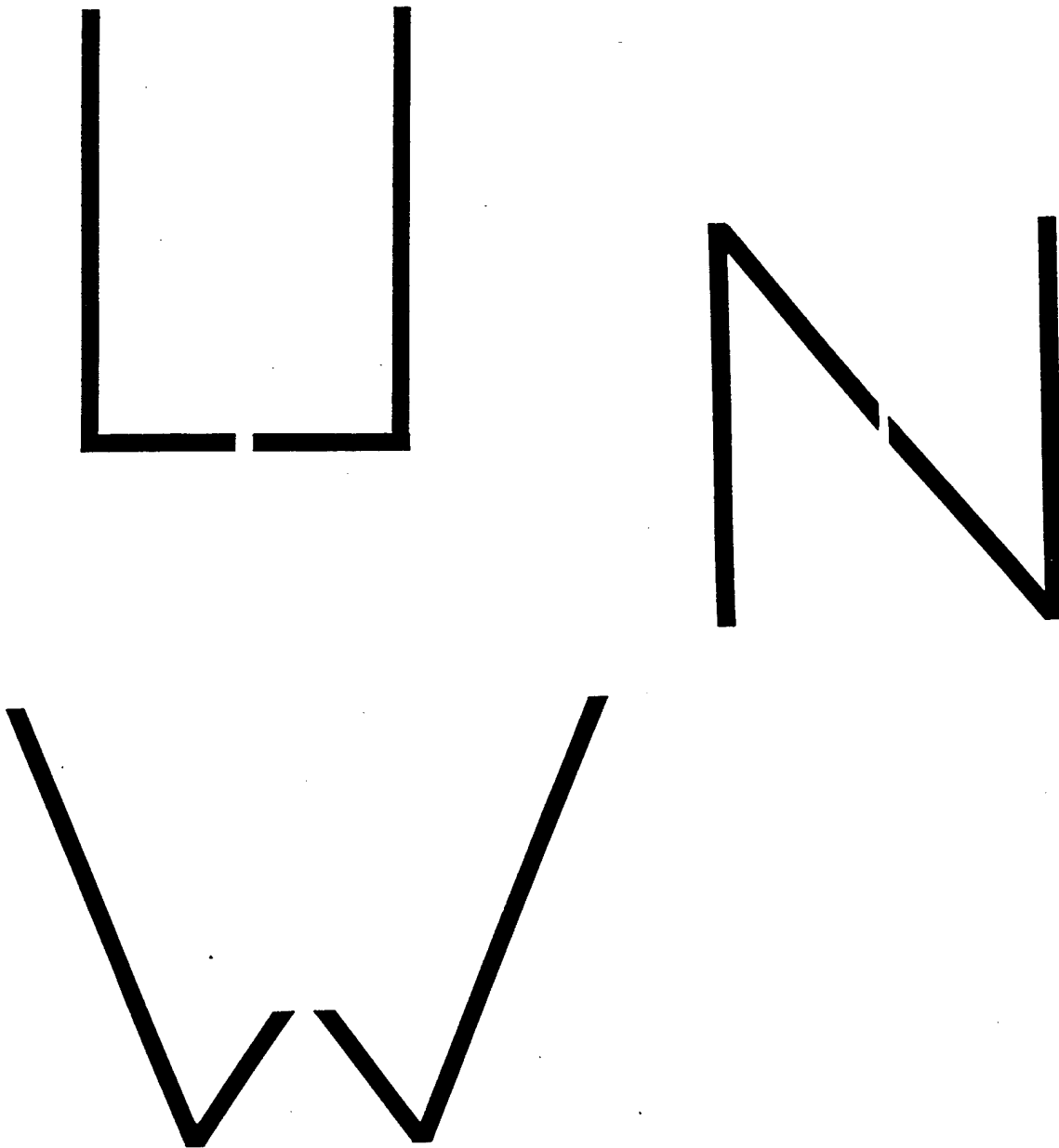
(Tracking and Data Relay Satellite System). This data is in Appendices 7 and 8 of the October 15, 1992 progress report. Additionally as described in this report, cellular telephone letter decal antennas development began with promising results. Wide angle bowtie dipoles for Argos (401 MHz) and cellular were also built and tested. Finally, to simulate a rooftop application, tests were performed with variable apertures and depths. These results are in Appendix V of this report, although it was determined that the larger the aperture the better the results.

The antennas that BCSD will deliver with this program are as follows:

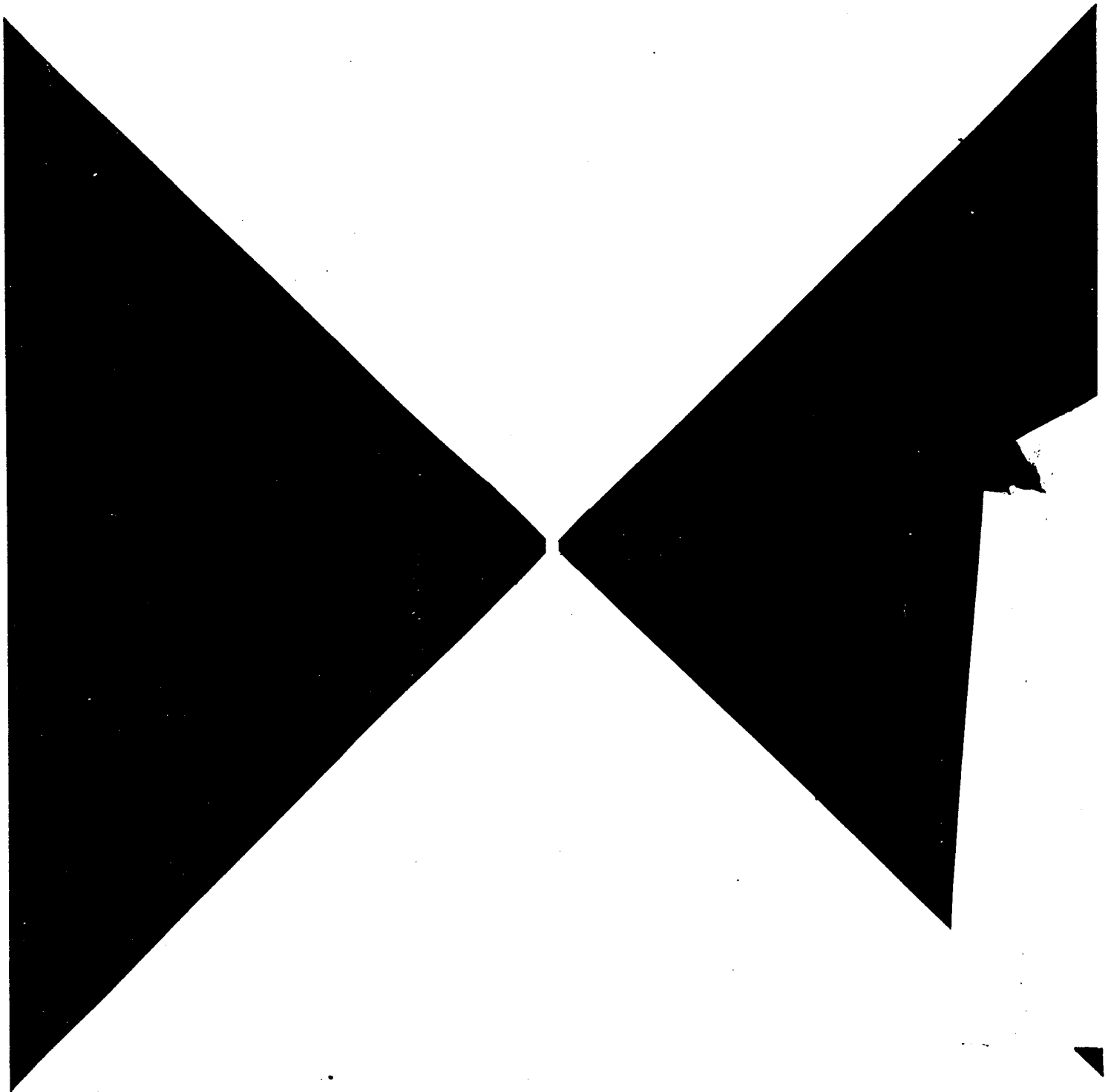
Item	Quantity	Description
1	3	Letter Decal Antennas (Letters, U, W, and N)
2	1	Argos 90 degree Bowtie Antenna
3	1	Cellular 90 degree Bowtie Antenna
4	1	Cellular Bent Monopole Antenna
5	1	Bifilar Helix Antenna for TDRSS

Overall this program was quite successful. First of all, the development of Satcom portable antenna and case evolved extremely well. Secondly, a good solid base of data has been taken from which further development may be guided by. For instance, the letter decal antennas are a very promising ones to explore further. Also, adding other functions to the portable silhouette case is another possibility. Additionally, adding other antennas and receivers to other cases is realizable, BCSD looks forward to continuing development in these areas in the near future.

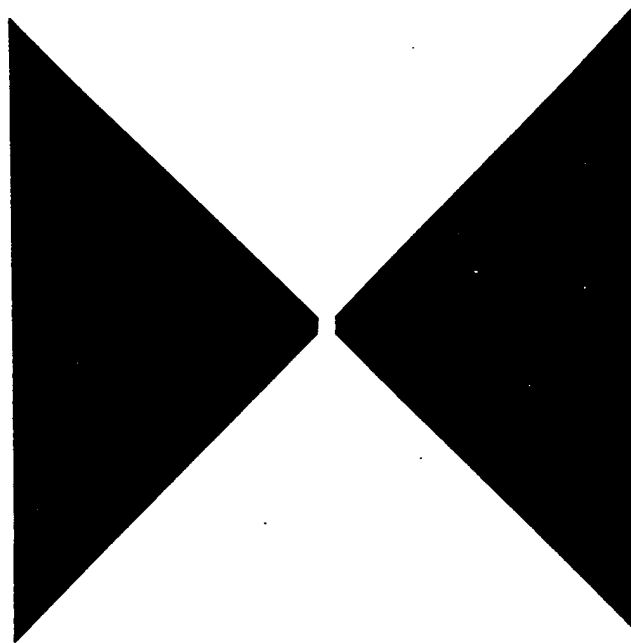
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NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By <i>per Acq. ltr.</i>	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	



**Figure 1. Letter Decal Antennas for Cellular Telephone (U, W, N)**



**Figure 2. Argos 90° Bowtie Dipole Antenna (401 MHz)**



**Figure 3. Cellular 90° Bowtie Antenna**





Cellular Bent Monopole  
Copper Monopole = 0.035 Thick  
Board Material = 0.060 in.

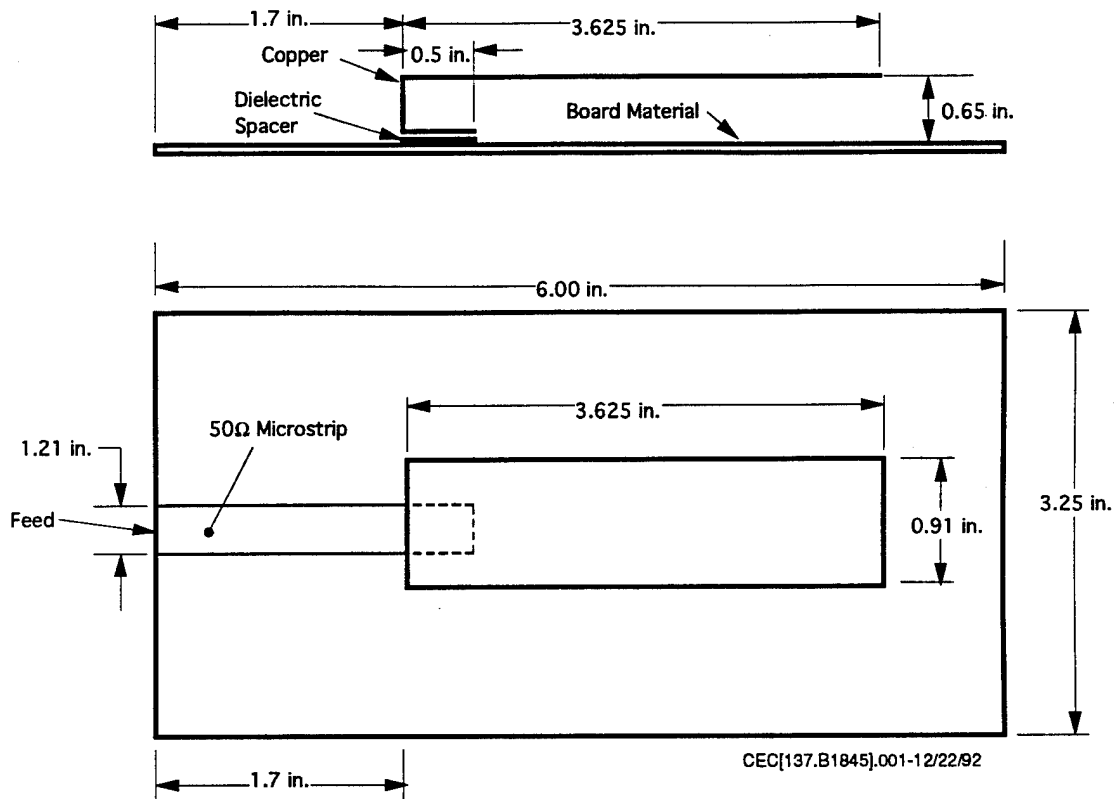


Figure 4. Cellular Bent Monopole Antenna



## **Appendix I**

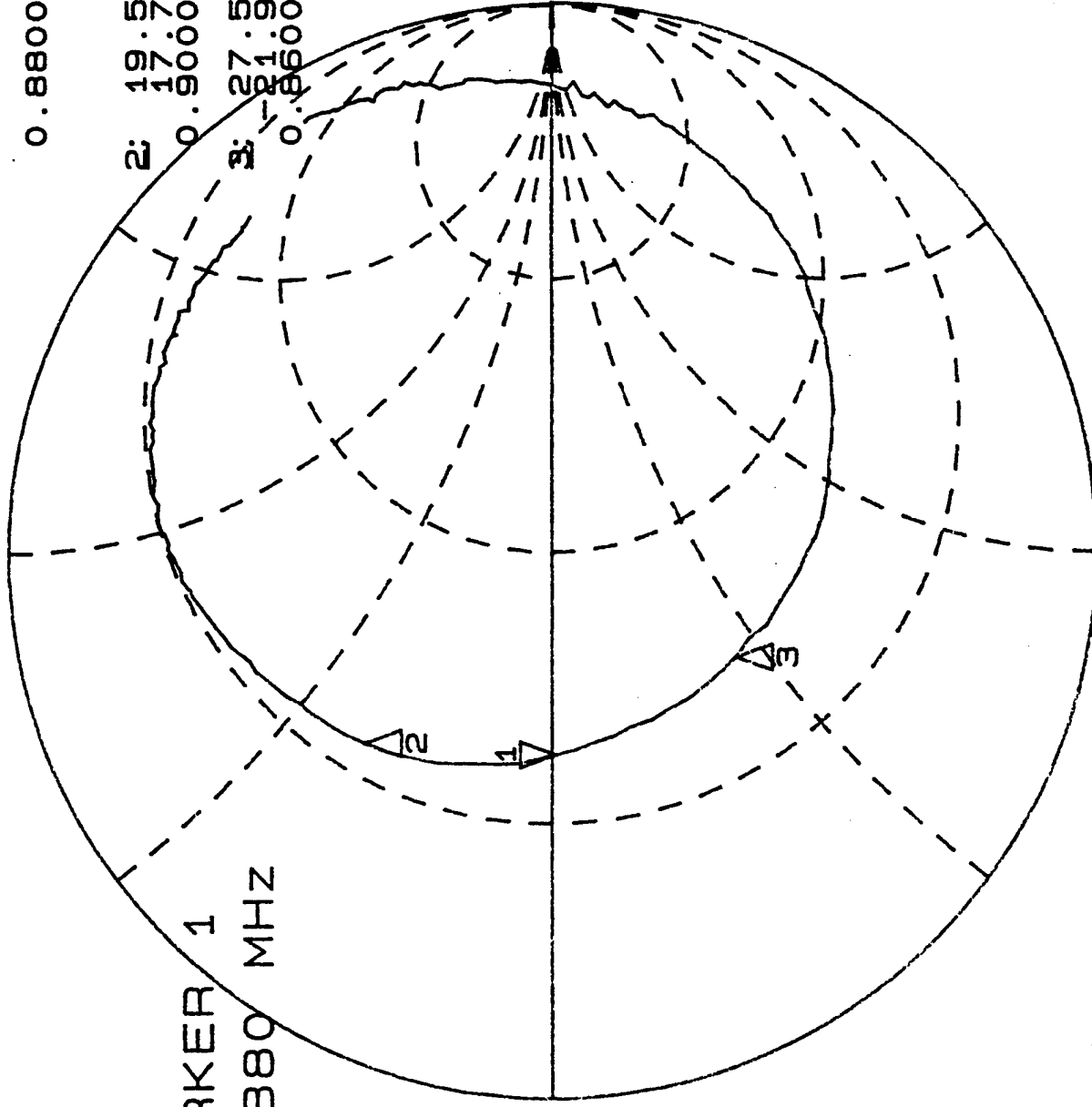
### **Letter Decal Antennas**

1: 22.958  $\Omega$  -413.09 m $\Omega$  437.82 pF  
0.8800 GHz

437.82 pF  
0.8800 GHz

2: 19:599 GHz  
17:793 GHz  
0:9000 GHz

3: 7:588 GHz  
21:938 GHz  
0:9000 GHz



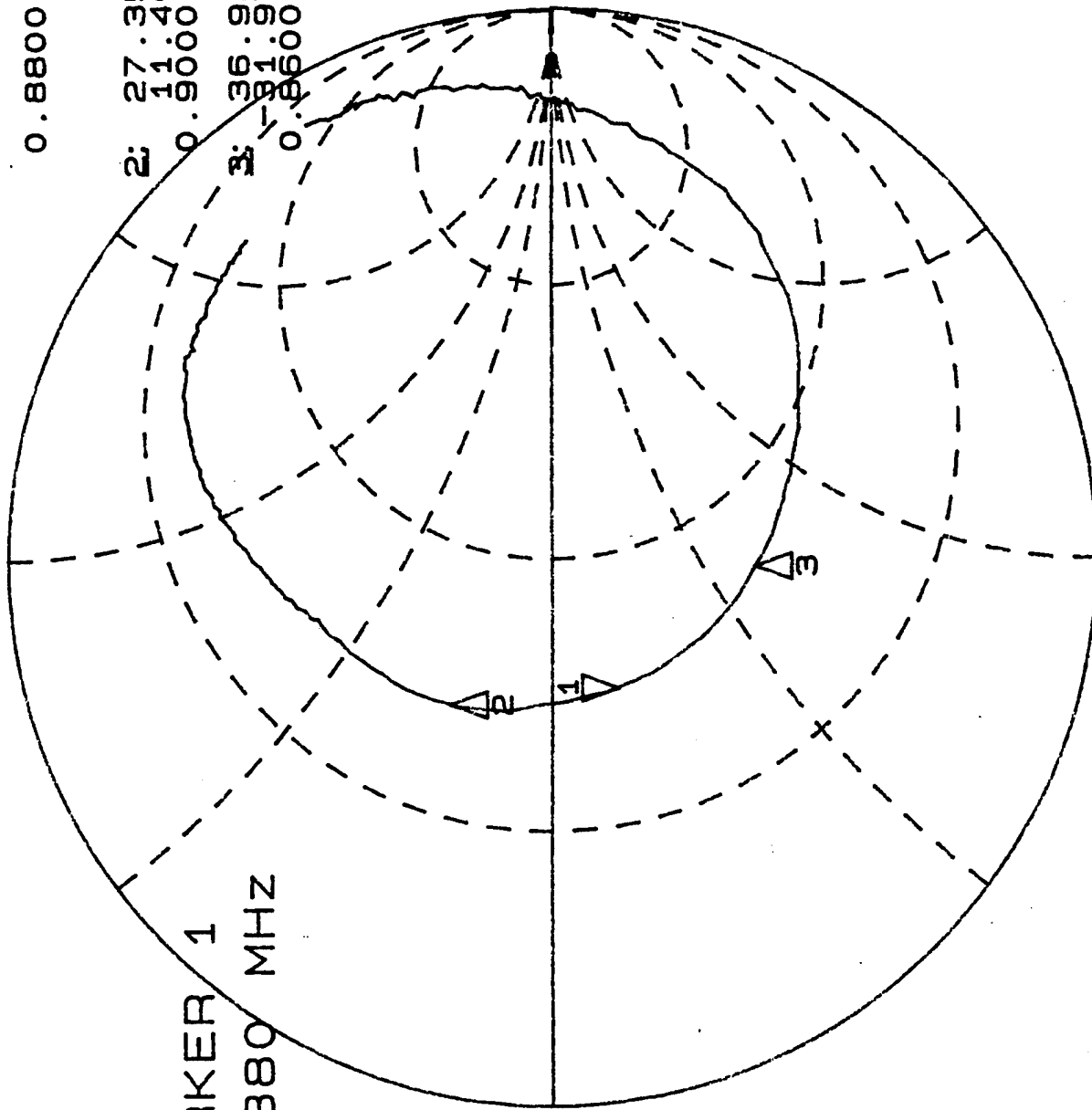
SPAN 0.4000 GHz

CH1 S22 1 U FS 1: 30.159  $\Omega$  -7.9189  $\Omega$  22.839 pF  
 12-17-92  
 Letter N

0.8800 GHZ

2: 27.353  $\Omega$   
 11.407  $\Omega$   
 0.9000 GHZ  
 3: 36.98  $\Omega$   
 31.973  $\Omega$   
 0.8600 GHZ

Cor MARKER 1  
 Del 880 MHZ



SPAN 0.4000 GHZ

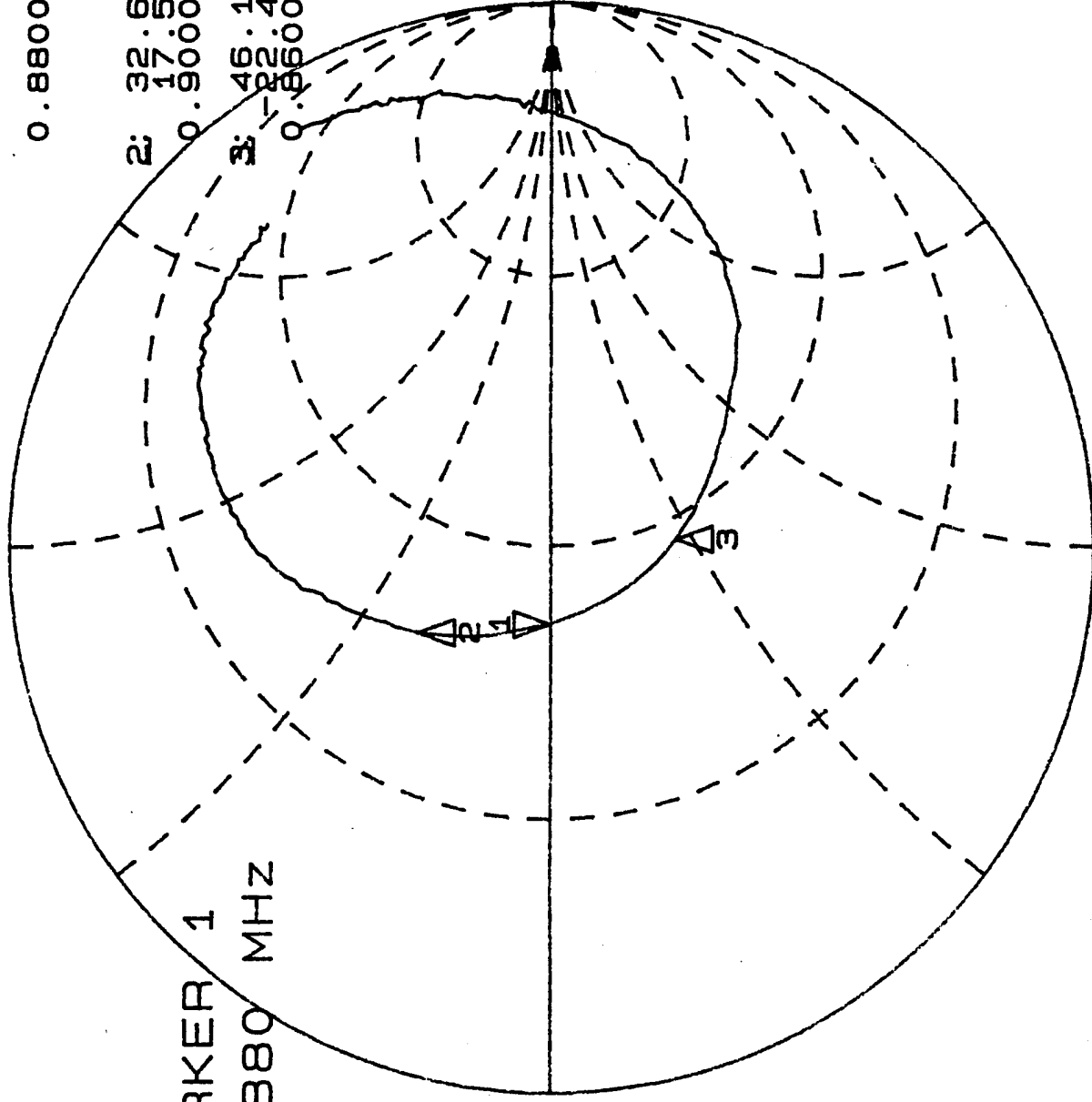
CENTER 0.8800 GHZ

८५

Col Del

MARKER/1

880 MHz



CENTER 0.8800 GHZ

SPAN 0.4000 GHz

Letter W  
12-17-92

ELEVATION  
17 DEC 92

860MHz A--AMPLITUDE PHI=  
860MHz A--AMPLITUDE PHI=

0deg NORMALIZED BY  
0deg NORMALIZED BY

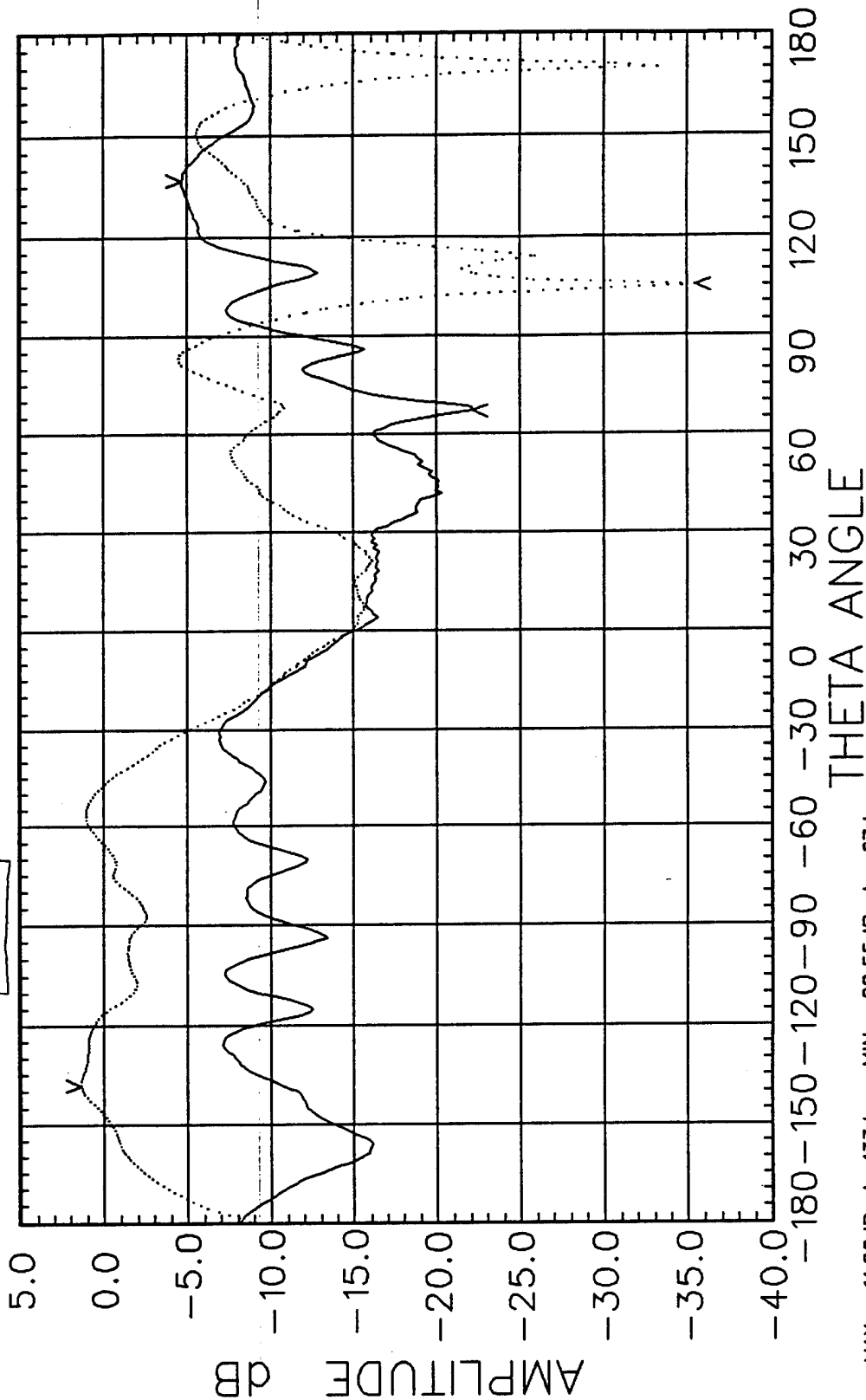
6.35dB DF1341 HAS  
5.84dB DF1351 HAS

0dB IF ATTEN SOURCE=  
0dB IF ATTEN SOURCE=

90deg → H  
0deg → V

# TAGGANT BENT MONOPOL

BALL AEROSPACE



— MAX: -11.02dB at 137deg MIN: -28.55dB at 67deg  
.... MAX: -4.47dB at -138deg MIN: -41.35dB at 105deg

1) RPLUT19 MAY 92  
2) RPLUT19 MAY 92

ELEVATION  
17 DEC 92

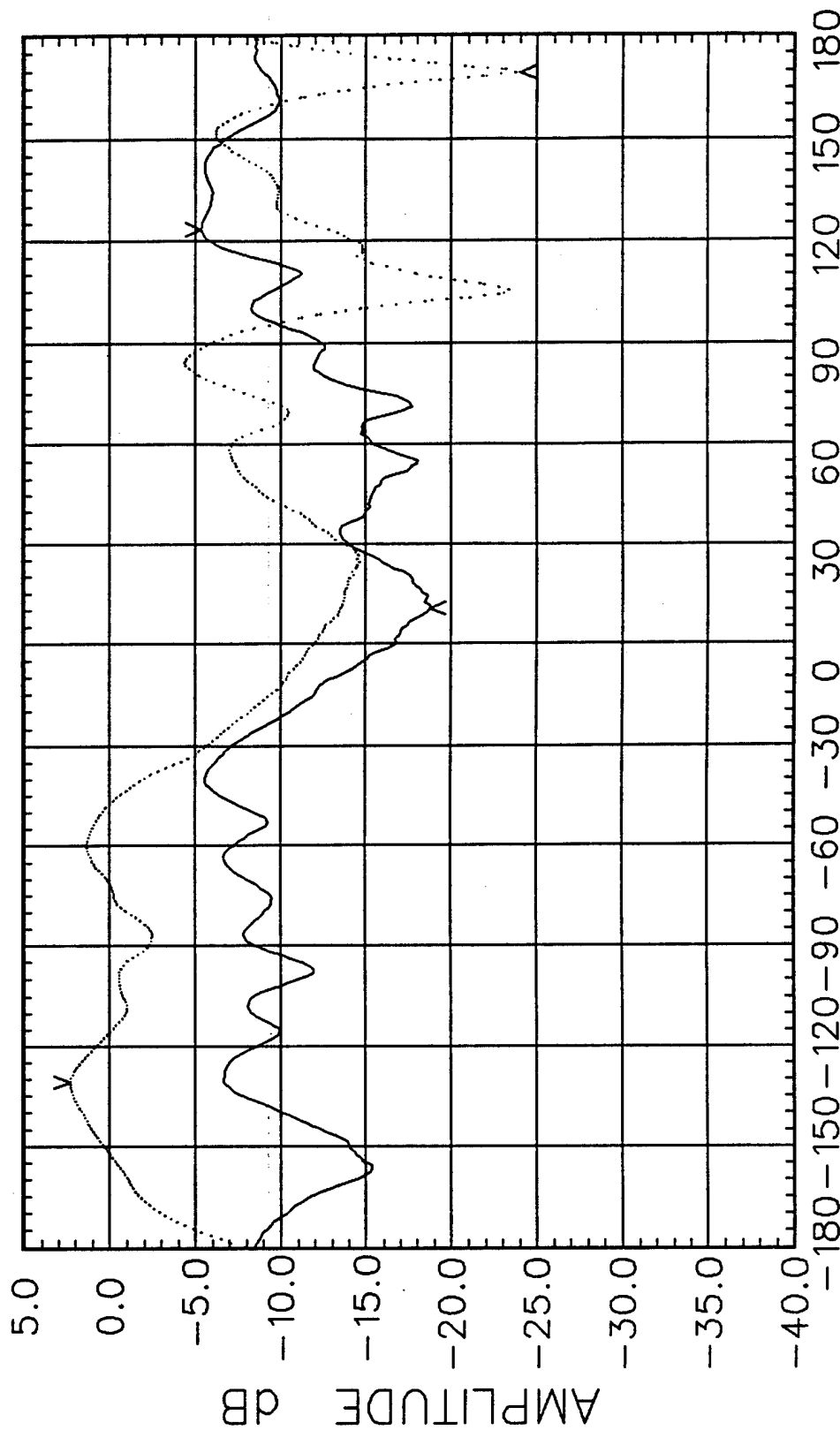
— is 880MHz A-AMPLITUDE PHI=  
... is 880MHz A-AMPLITUDE PHI=

0deg NORMALIZED BY 5.26dB DF1342 HAS  
0deg NORMALIZED BY 4.80dB DF1352 HAS

0dB IF ATTEN SOURCE= 90deg  
0dB IF ATTEN SOURCE= 0deg

# TAGGANT BENT MONOPOL

BALL AEROSPACE



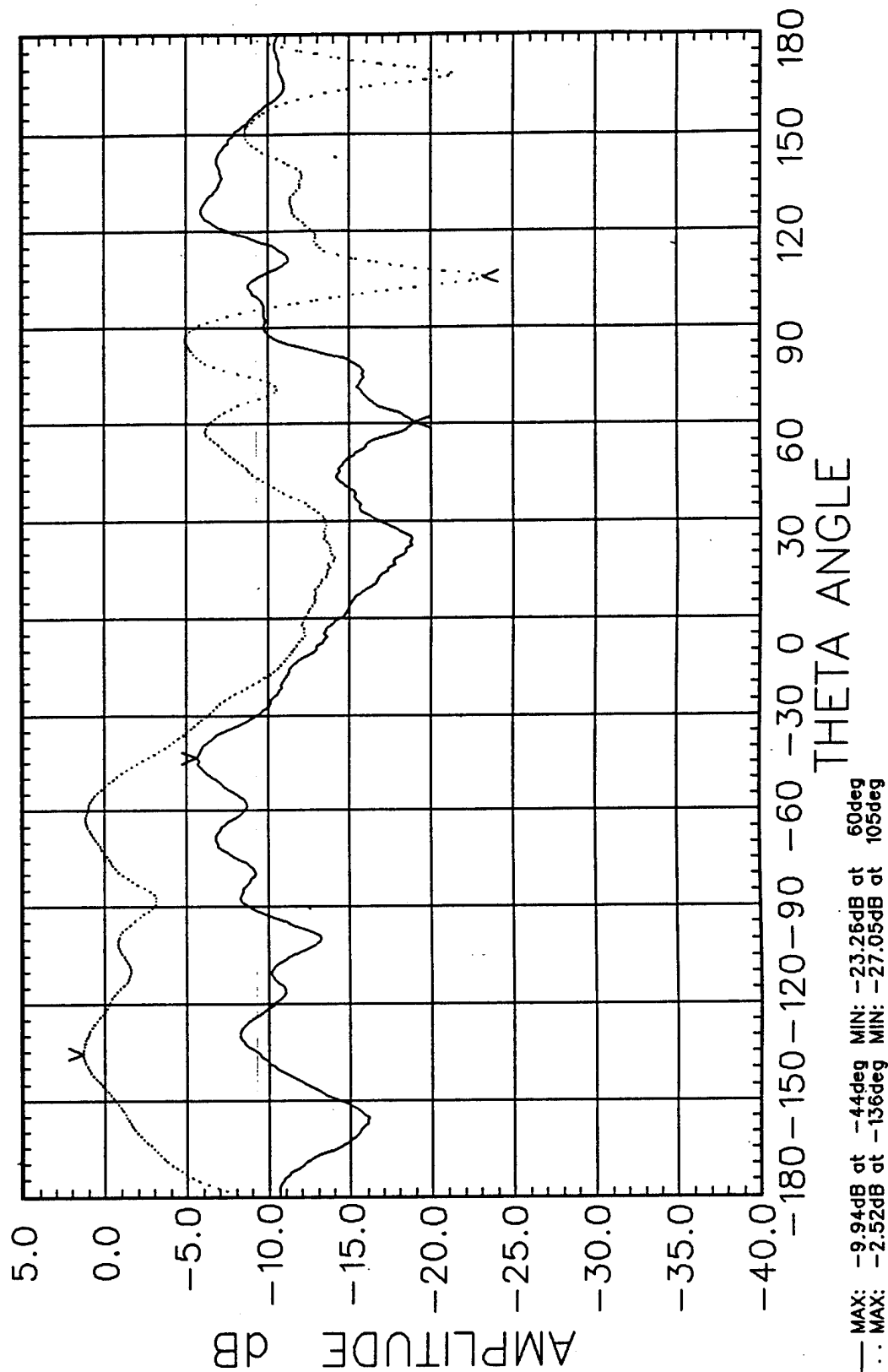
1) RPL01:19 MAY 92  
2) RPL01:19 MAY 92

ELEVATION  
17 DEC 92

BALL AEROSPACE

# TAGGANT BENT MONOPOL

900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 4.27dB DF1343 HAS 0dB IF ATTEN SOURCE= 90deg H  
900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 3.84dB DF1353 HAS 0dB IF ATTEN SOURCE= 0deg V



2) RPLT: 19 MAY 92

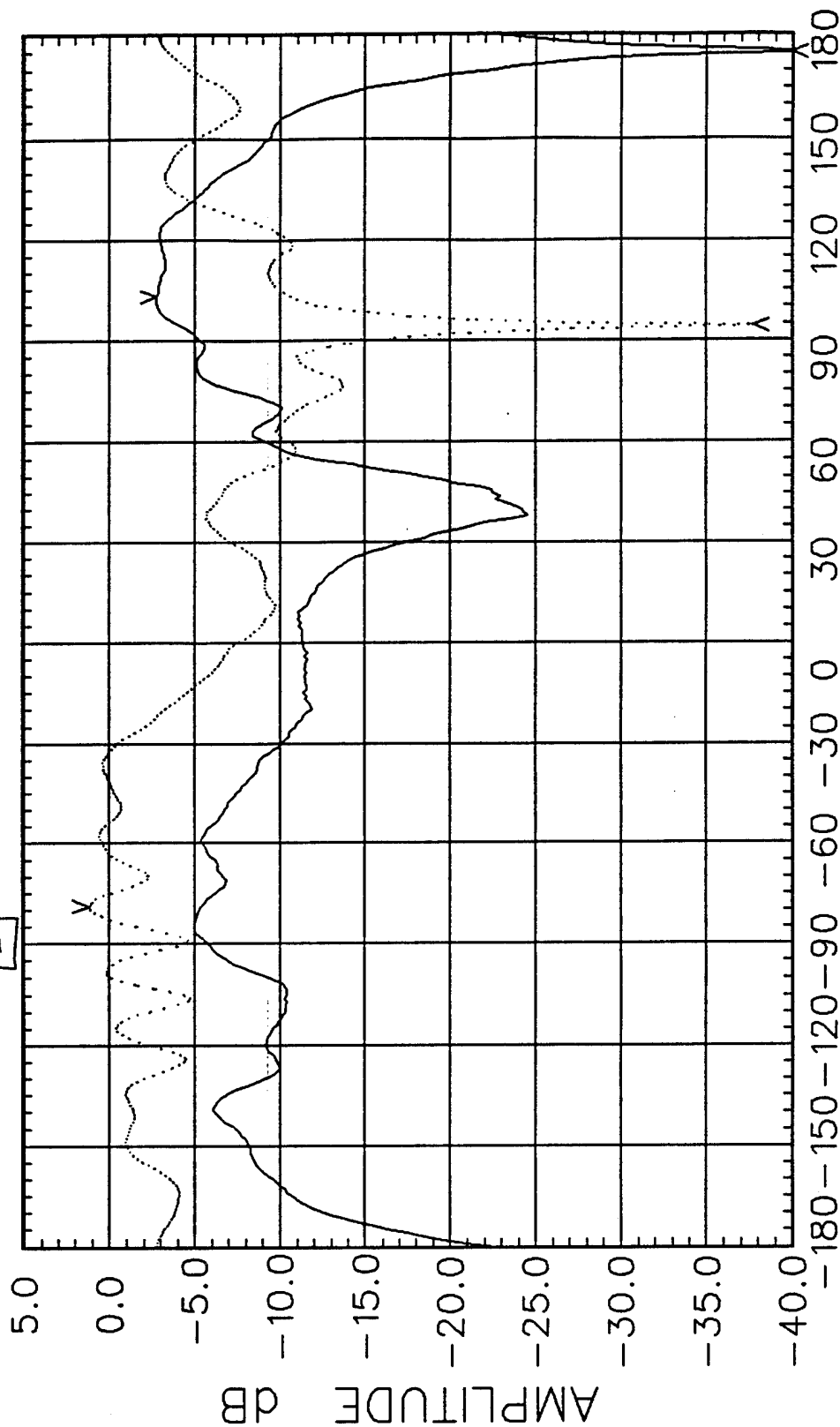


AZIMUTH  
17 DEC 92

BALL AEROSPACE

# TAGGANT BENT MONOPOL

is 860MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 5.84dB DF1321 HAS 0dB IF ATTEN SOURCE= 0deg V  
... is 860MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 6.35dB DF1331 HAS 0dB IF ATTEN SOURCE= 90deg H



THETA ANGLE

— MAX: -8.60dB at 103deg MIN: -49.17dB at 175deg  
... MAX: -5.15dB at -79deg MIN: -44.12dB at 94deg

1) RFLDT:19 MAY 92  
2) RFLDT:19 MAY 92

12  
→

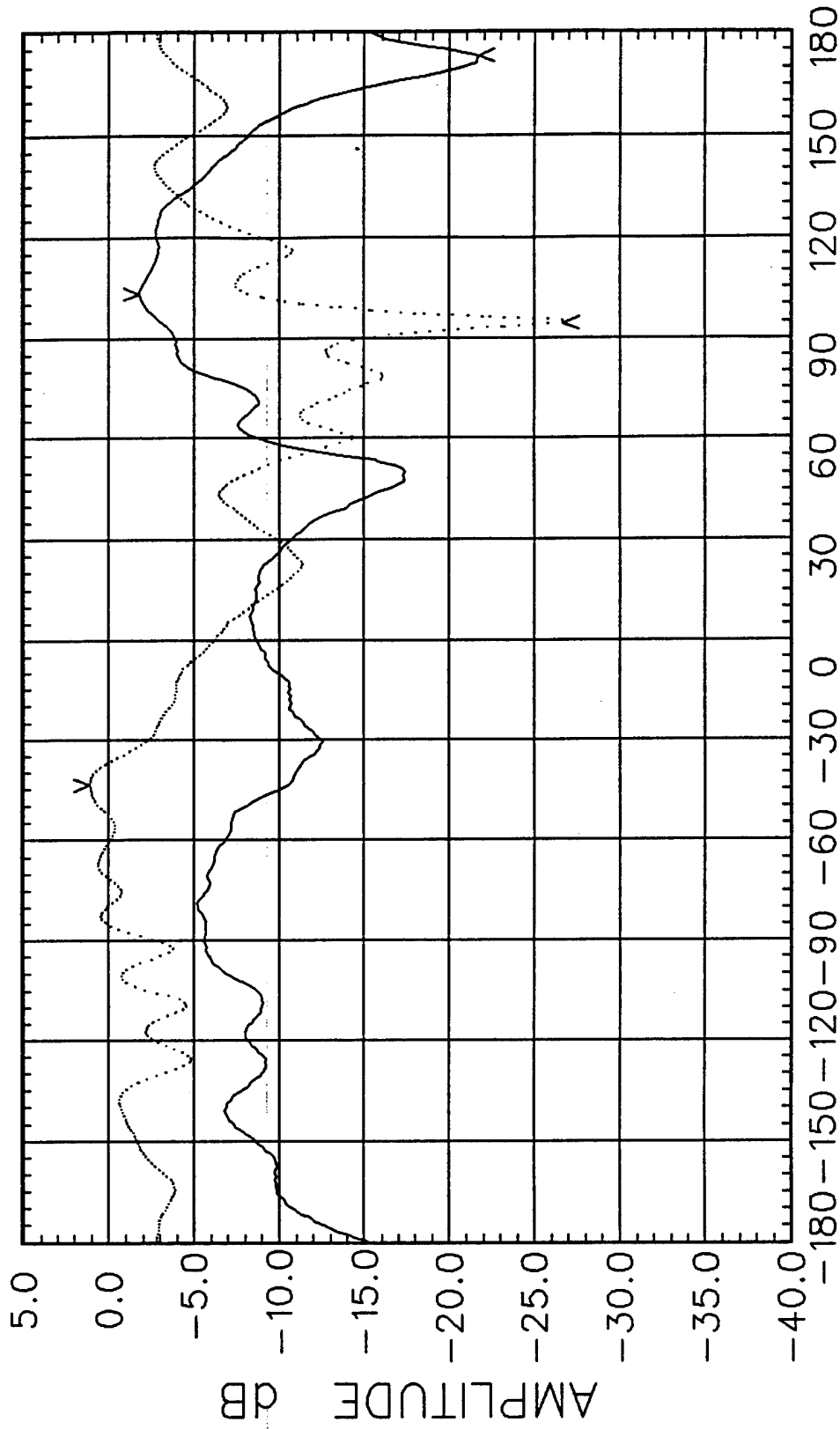
AZIMUTH  
17 DEC 92

— is 880MHz A-AMPLITUDE PHI=  
..... is 880MHz A-AMPLITUDE PHI=

# TAGGANT BENT MONOPOL

BALL AEROSPACE

0deg NORMALIZED BY 4.80dB DF1322 HAS 0dB IF ATTEN SOURCE= 0deg V  
0deg NORMALIZED BY 5.26dB DF1332 HAS 0dB IF ATTEN SOURCE= 90deg H



— MAX: -6.59dB at 103deg MIN: -26.51dB at 173deg  
..... MAX: -4.17dB at -44deg MIN: -31.97dB at 94deg

AZIMUTH

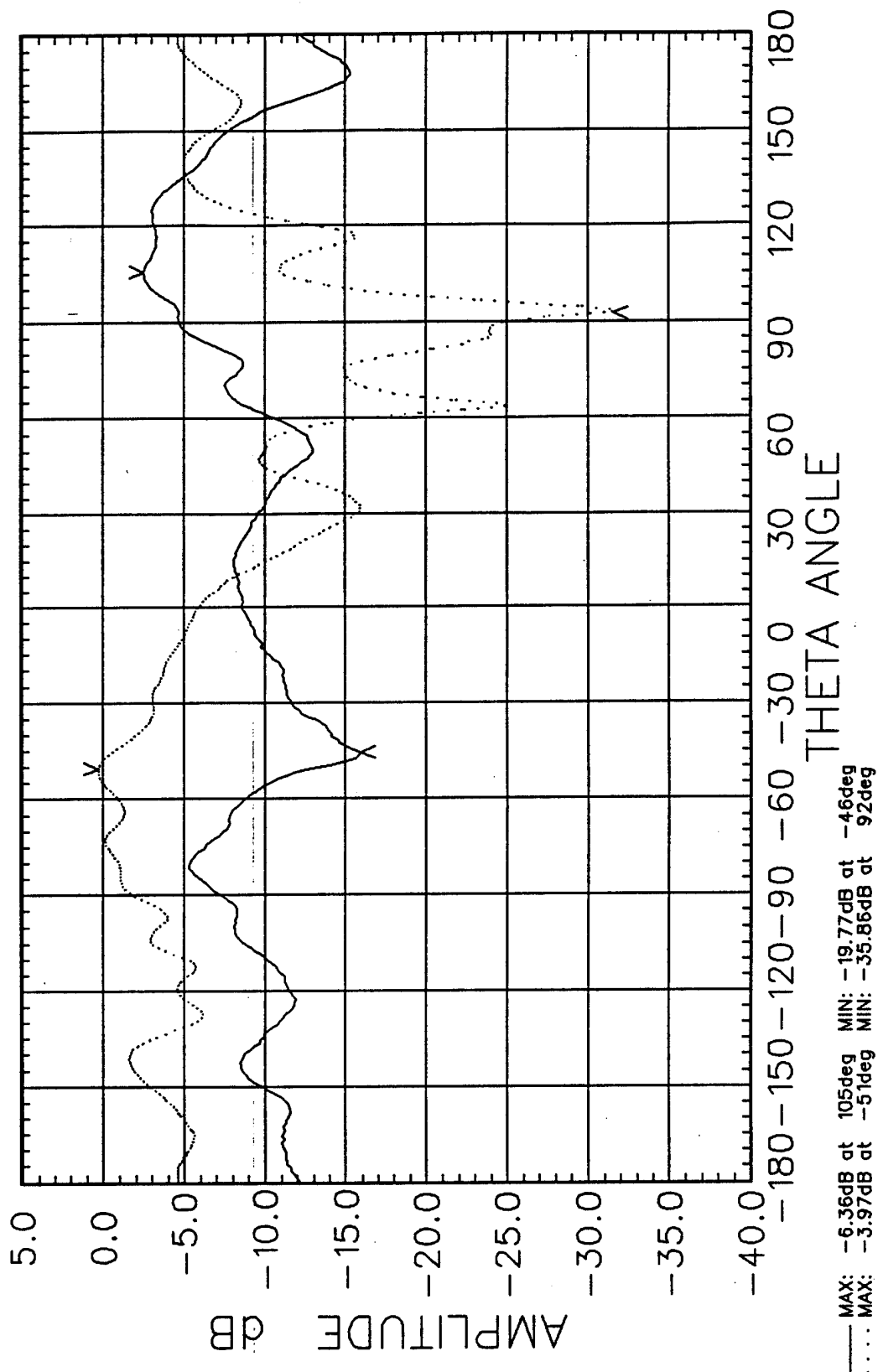
17 DEC 92

— is 900MHz A—AMPLITUDE PHI=  
... is 900MHz A—AMPLITUDE PHI=

# TAGGANT BENT MONOPOL

BALL AEROSPACE

0deg NORMALIZED BY 3.84dB DF1323 HAS 0dB IF ATTEN SOURCE= 0deg V  
0deg NORMALIZED BY 4.27dB DF1333 HAS 0dB IF ATTEN SOURCE= 90deg H



1) RPL01:19 MAY 92  
2) RPL01:19 MAY 92

AZIMUTH

17 DEC 92

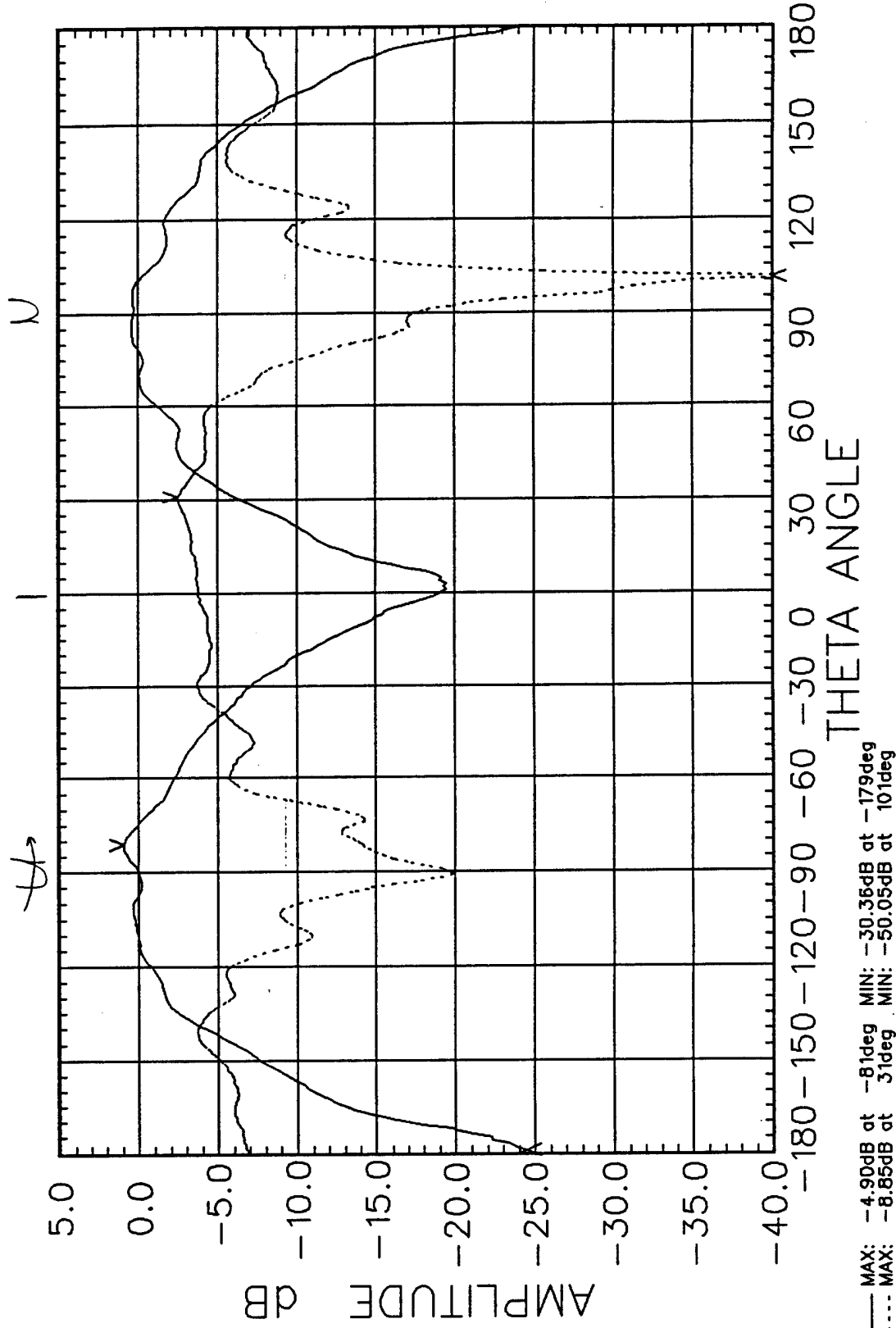
— is 860MHz A-AMPLITUDE PHI=  
- - - is 860MHz A-AMPLITUDE PHI=

0deg NORMALIZED BY 5.84dB DF1181 HAS 0dB IF ATTEN SOURCE=  
0deg NORMALIZED BY 6.35dB DF1191 HAS 0dB IF ATTEN SOURCE=

0deg V  
90deg H

BALL AEROSPACE

# TAGGANT LETTER U



AZIMUTH  
17 DEC 92

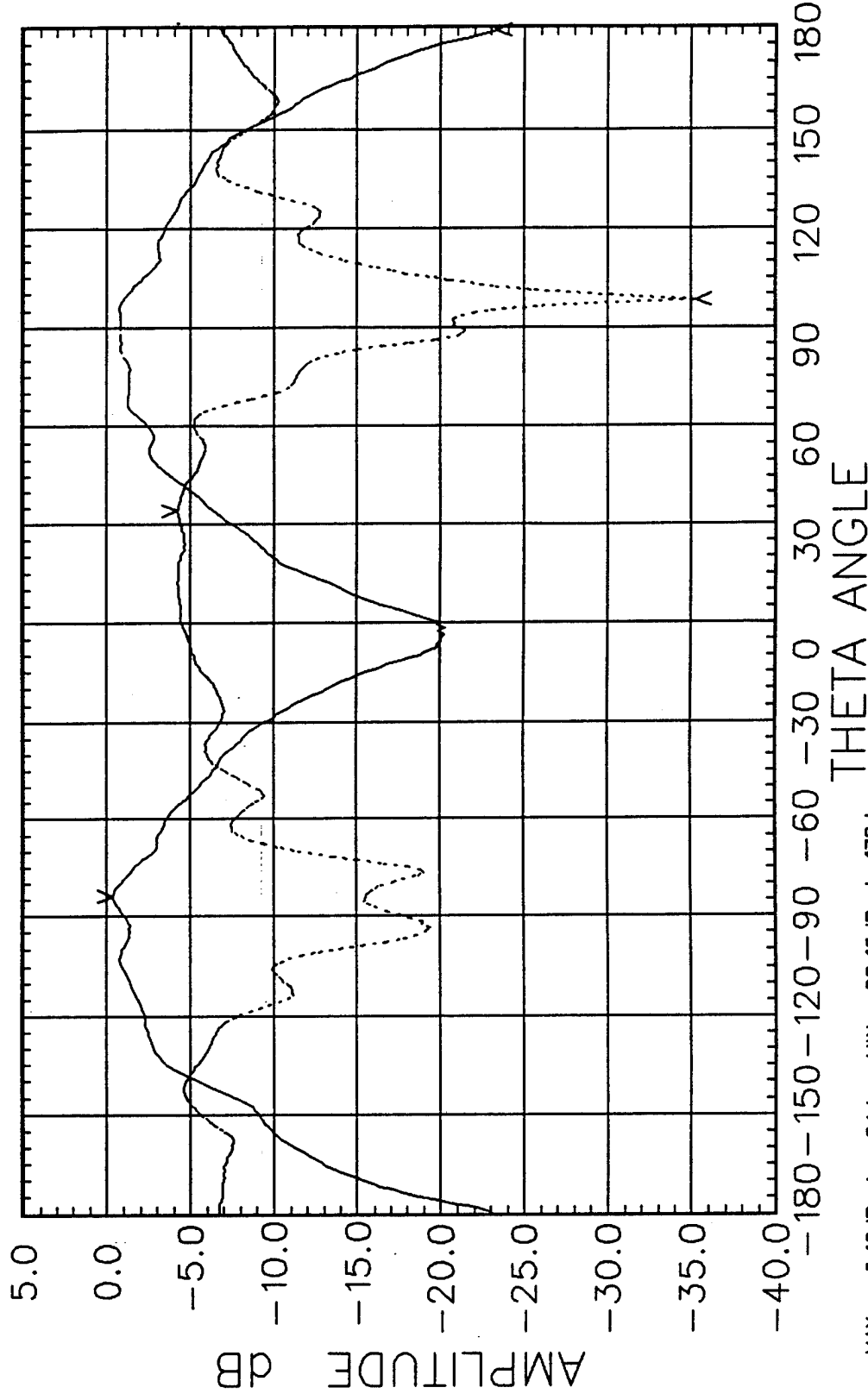
— is 880MHz A-AMPLITUDE PHI=  
- - - is 880MHz A-AMPLITUDE PHI=

# TAGGANT LETTER U

0deg NORMALIZED BY 4.80dB DF1182 HAS 0dB IF ATTEN SOURCE=  
0deg NORMALIZED BY 5.26dB DF1192 HAS 0dB IF ATTEN SOURCE=

BALL AEROSPACE

0deg V  
90deg H



— MAX: -5.16dB at -84deg MIN: -28.16dB at 179deg  
- - - MAX: -9.48dB at 34deg MIN: -40.55dB at 98deg

AZIMUTH

17 DEC 92

— is 900MHz A-AMPLITUDE PHI=  
..... is 900MHz A-AMPLITUDE PHI=

0deg

0deg

TAGGANT

LETTER U

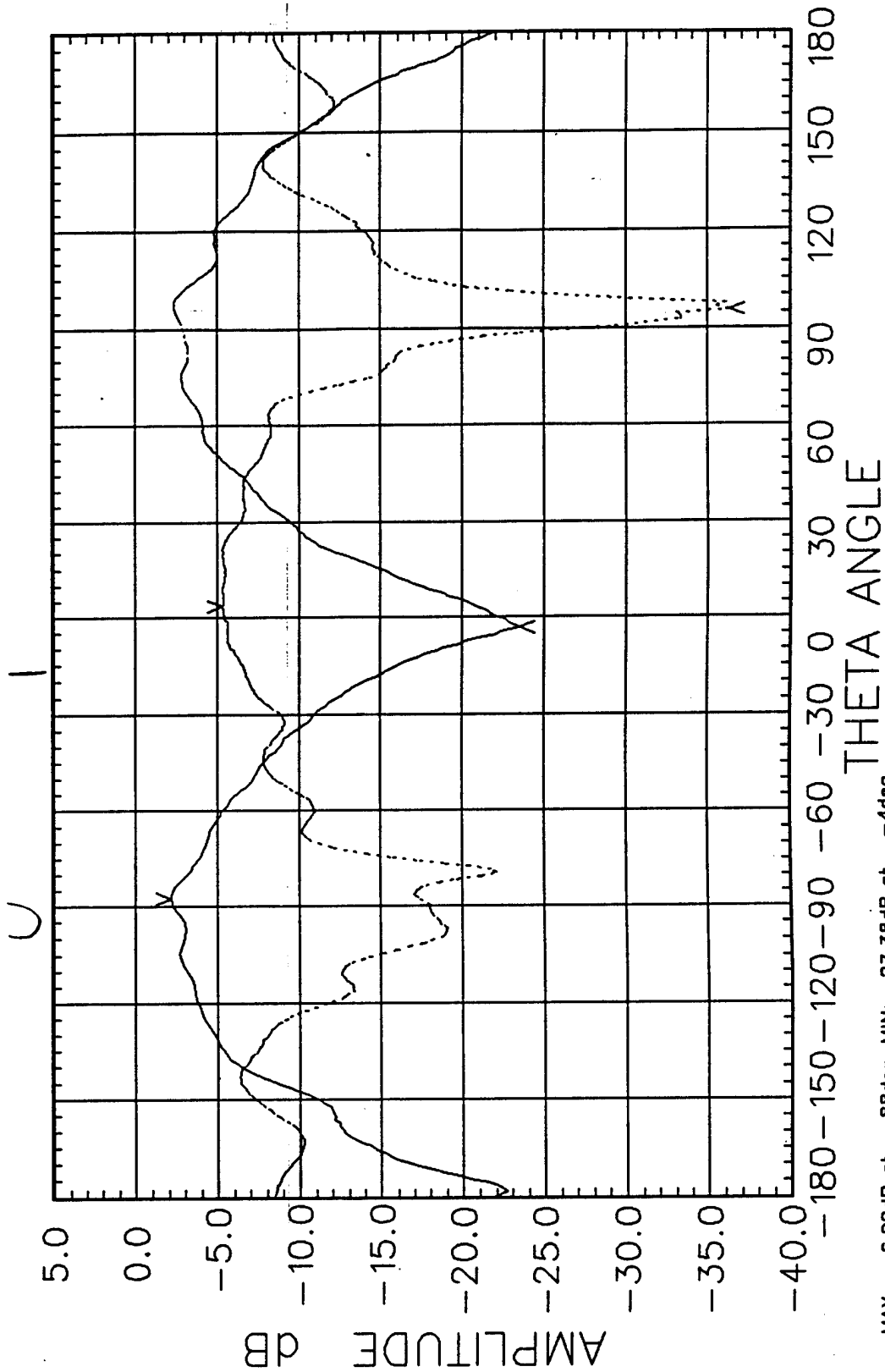
NORMALIZED BY 3.84dB DF1183 HAS 0dB IF ATTEN SOURCE=  
NORMALIZED BY 4.27dB DF1193 HAS 0dB IF ATTEN SOURCE=

0deg

90deg

BALL AEROSPACE

0deg V  
90deg H



— MAX: -6.02dB at -88deg MIN: -27.38dB at -4deg  
..... MAX: -9.60dB at 3deg MIN: -40.59dB at 95deg

1) PLOT: 19 MAY 92  
2)

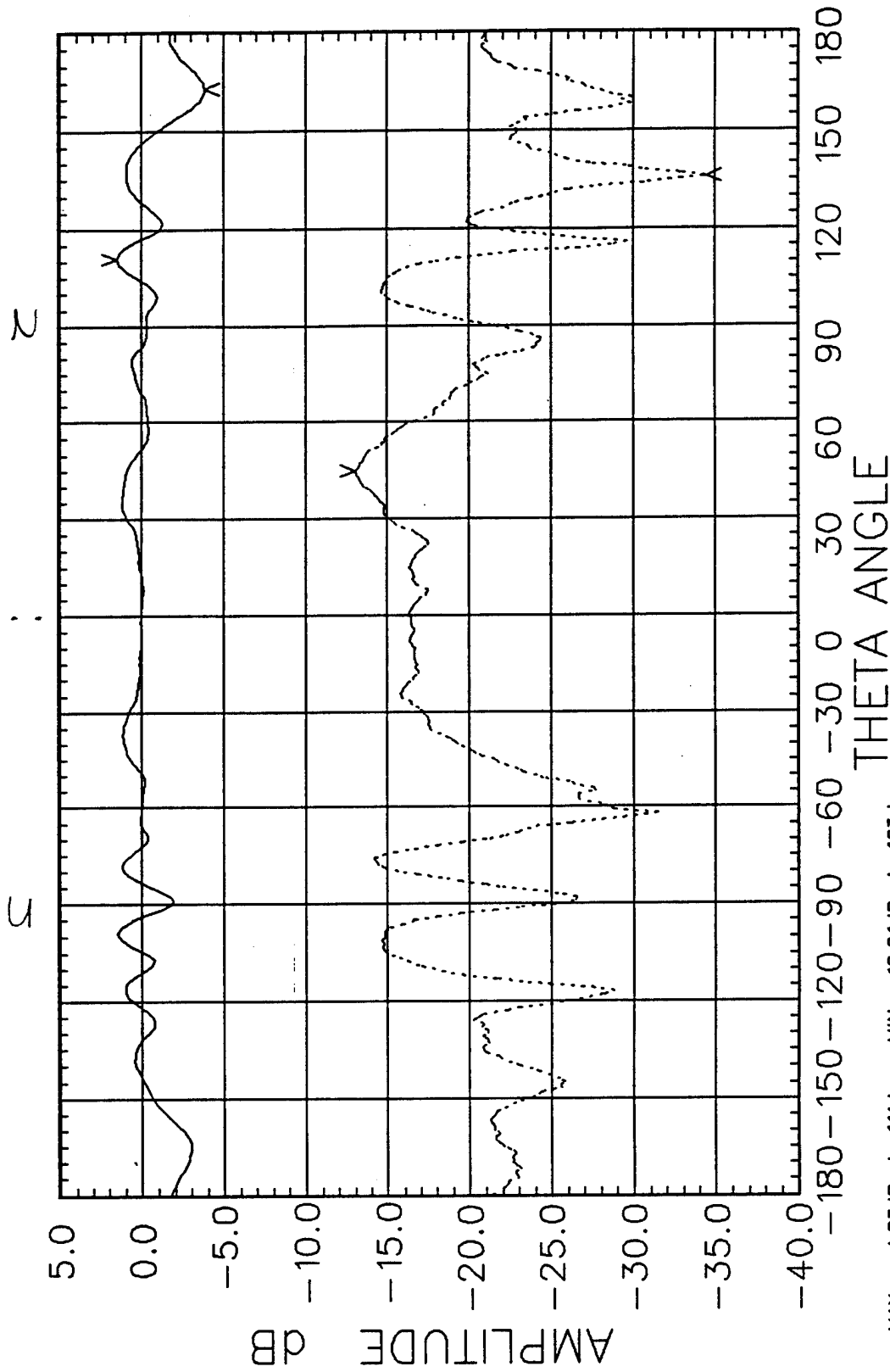
ELEVATION  
17 DEC 92

— is 860MHz A-AMPLITUDE PHI=  
..... is 860MHz A-AMPLITUDE PHI=

0deg NORMALIZED BY 6.35dB DF1161 HAS 0dB IF ATTEN SOURCE= 90deg V  
0deg NORMALIZED BY 5.84dB DF1171 HAS 0dB IF ATTEN SOURCE= 0deg H

# TAGGANT LETTER U

BALL AEROSPACE



— MAX: -4.83dB at 111deg MIN: -10.21dB at 163deg  
..... MAX: -18.90dB at 45deg MIN: -40.28dB at 136deg

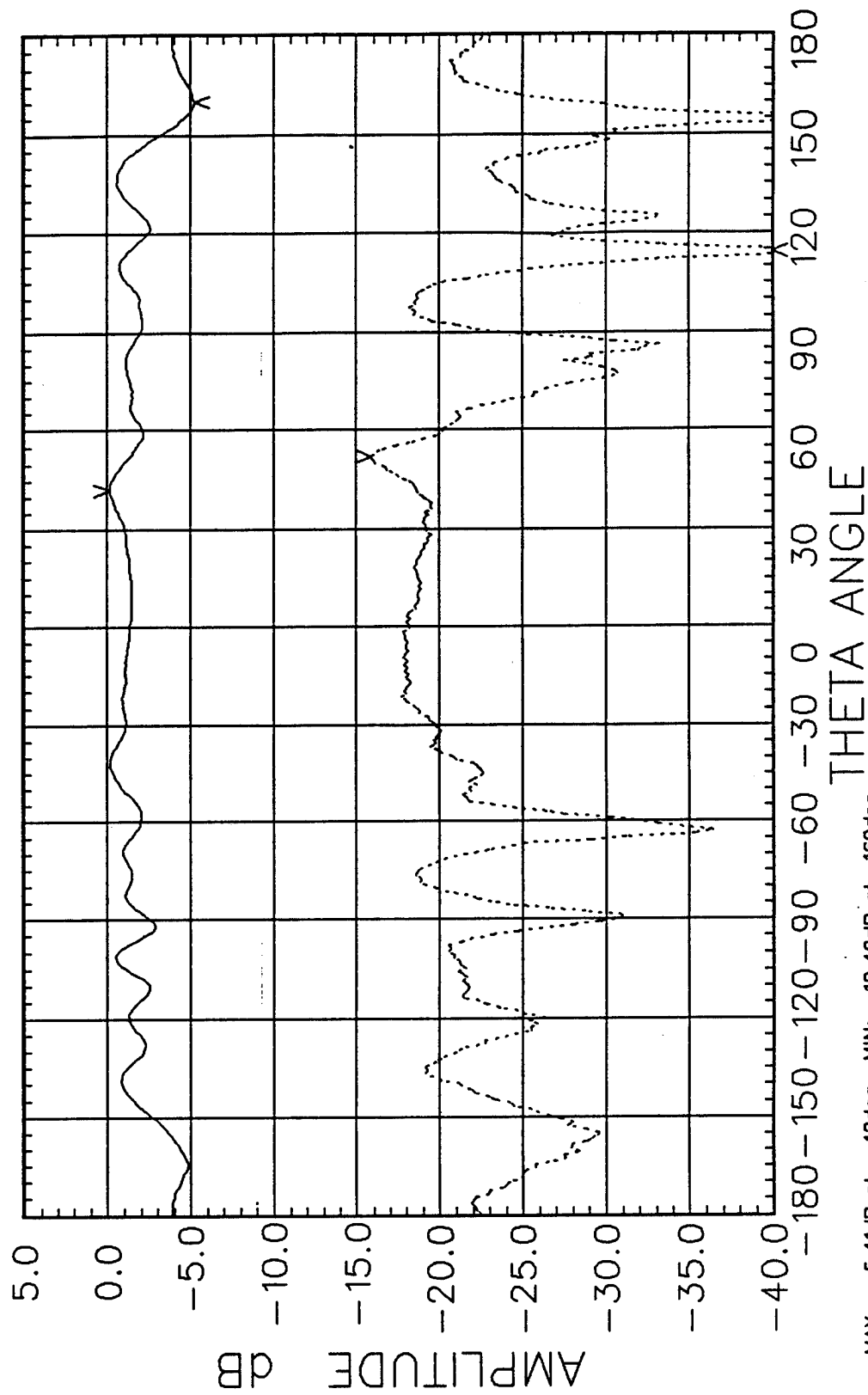
1) RELOT:19 MAY 92  
2) RELOT:19 MAY 92

ELEVATION  
17 DEC 92

BALL AEROSPACE

# TAGGANT LETTER U

880MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 5.26dB DF1162 HAS 0dB IF ATTEN SOURCE= 90deg V  
880MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 4.80dB DF1172 HAS 0dB IF ATTEN SOURCE= 0deg H



— MAX: -5.41dB at 42deg MIN: -10.49dB at 160deg  
- - - MAX: -20.67dB at 52deg MIN: -54.56dB at 114deg

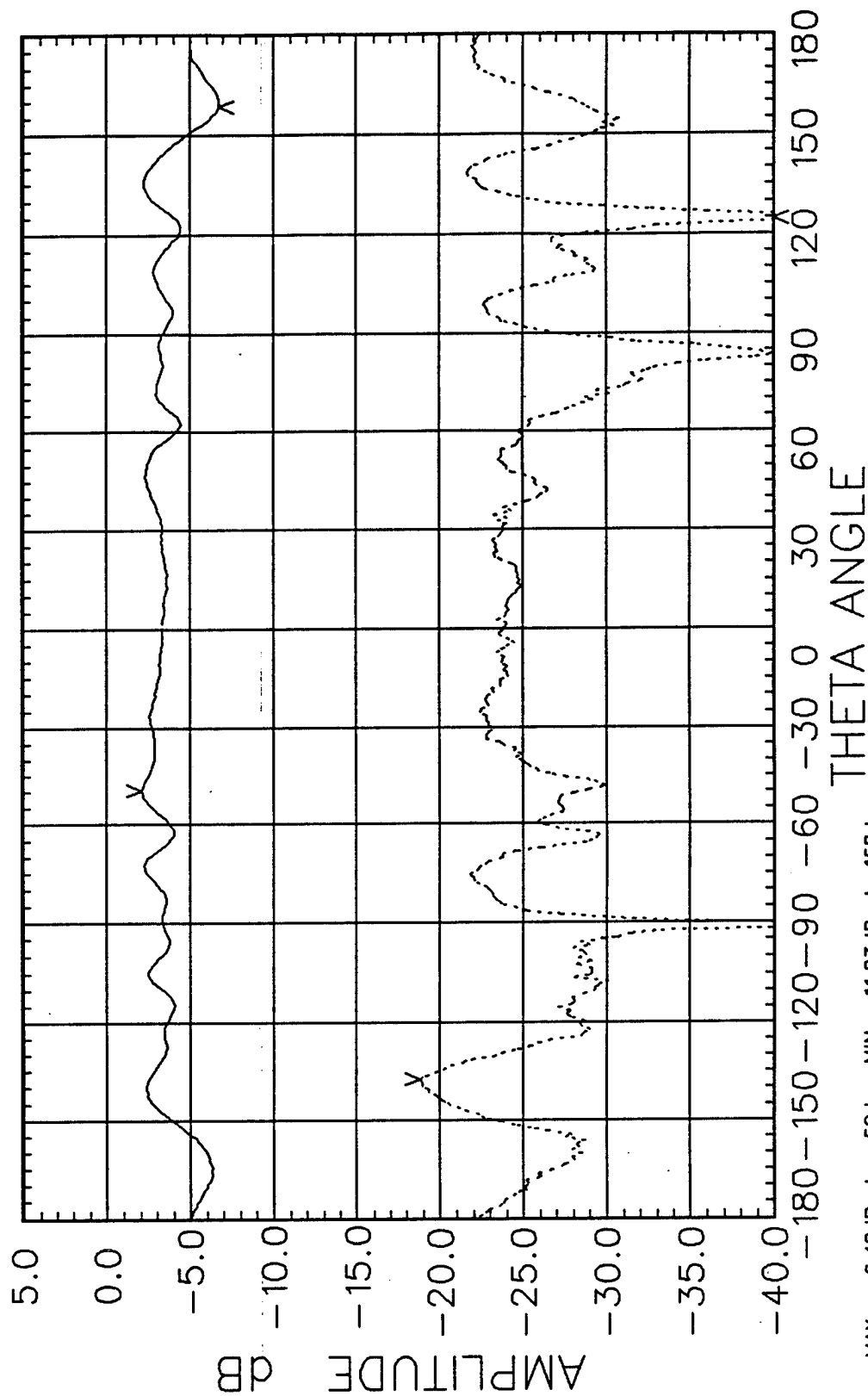


ELEVATION  
17 DEC 92

BALL AEROSPACE

# TAGGANT LETTER U

900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 4.27dB DF1163 HAS 0dB IF ATTEN SOURCE= 90deg V  
900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 3.84dB DF1173 HAS 0dB IF ATTEN SOURCE= 0deg H



MAX: -6.40dB at -50deg MIN: -11.03dB at 158deg  
MAX: -22.65dB at -138deg MIN: -48.81dB at 124deg

1) RPL01:19 MAY 92  
2) RPL01:19 MAY 92

AZIMUTH  
17 DEC 92

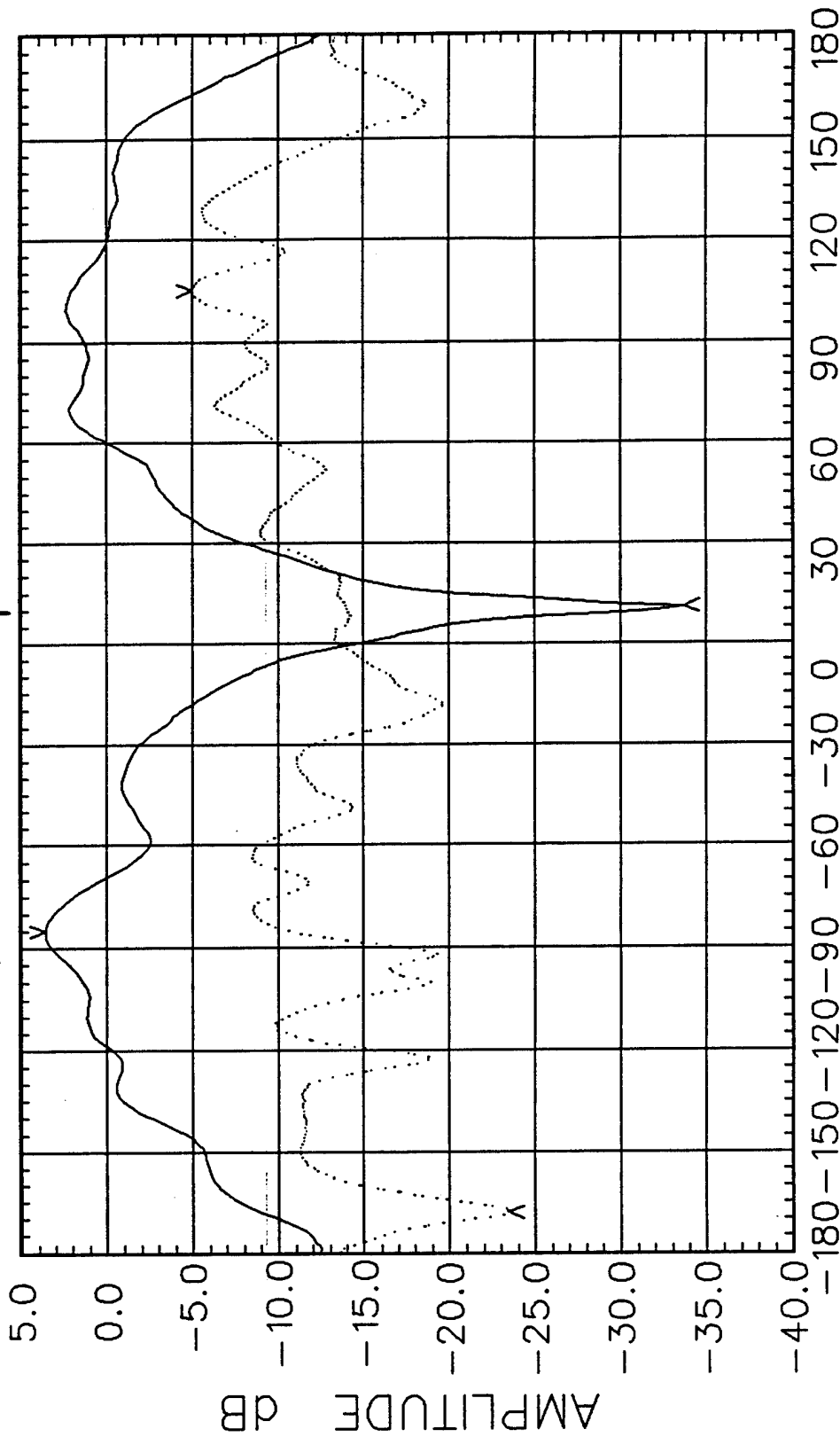
— is 860MHz A-AMPLITUDE PHI=  
.... is 860MHz A-AMPLITUDE PHI=

0deg NORMALIZED BY 5.84dB DF1281 HAS 0deg V  
0deg NORMALIZED BY 6.35dB DF1291 HAS 0deg H

BALL AEROSPACE

# TAGGANT LETTER N

N →



— MAX: -2.27dB at -85deg MIN: -39.55dB at 11deg  
.... MAX: -11.33dB at 105deg MIN: -29.82dB at -168deg

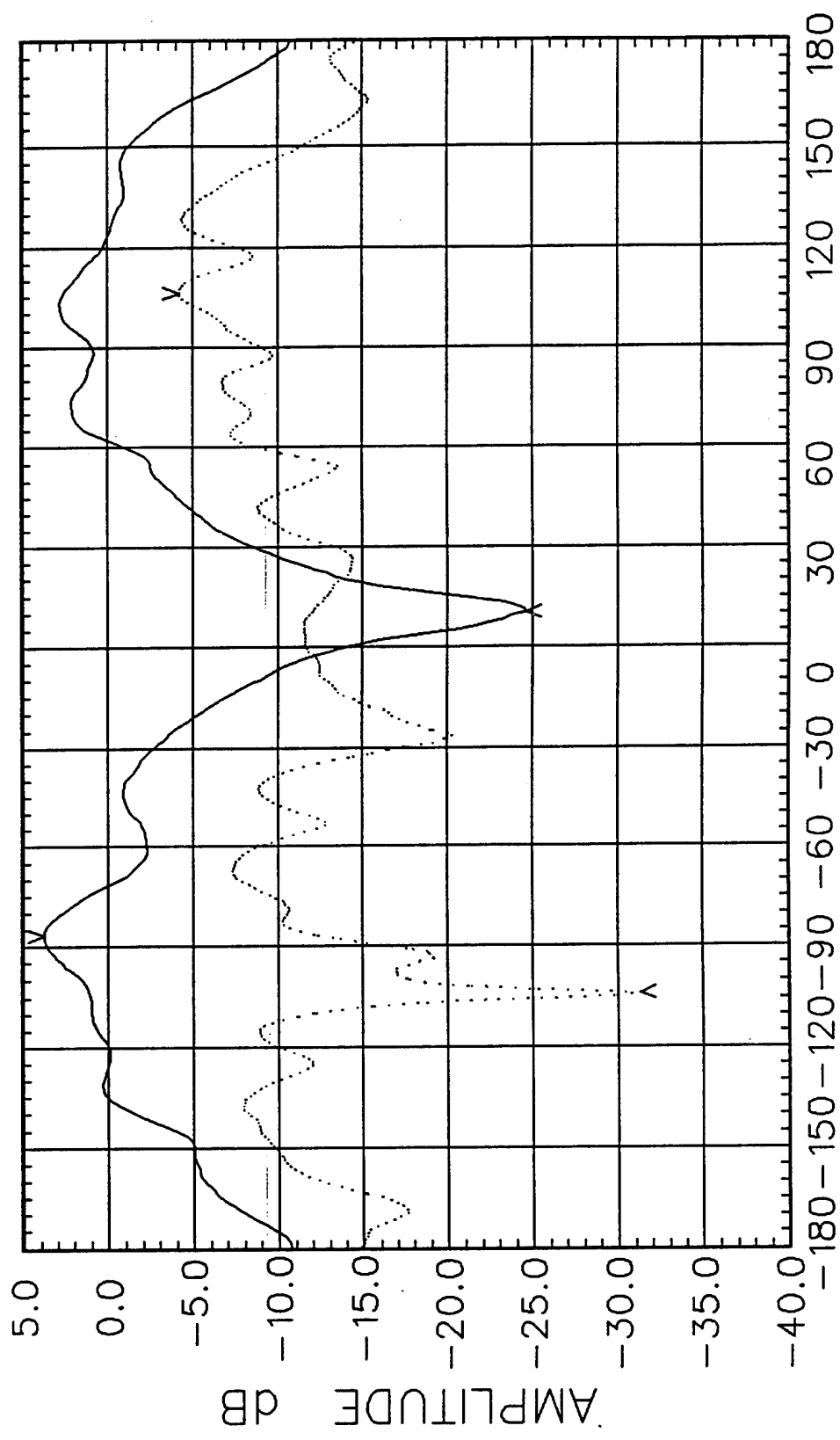
AZIMUTH  
17 DEC 92

— is 880MHz A-AMPLITUDE PHI=  
... is 880MHz A-AMPLITUDE PHI=

# TAGGANT LETTER N

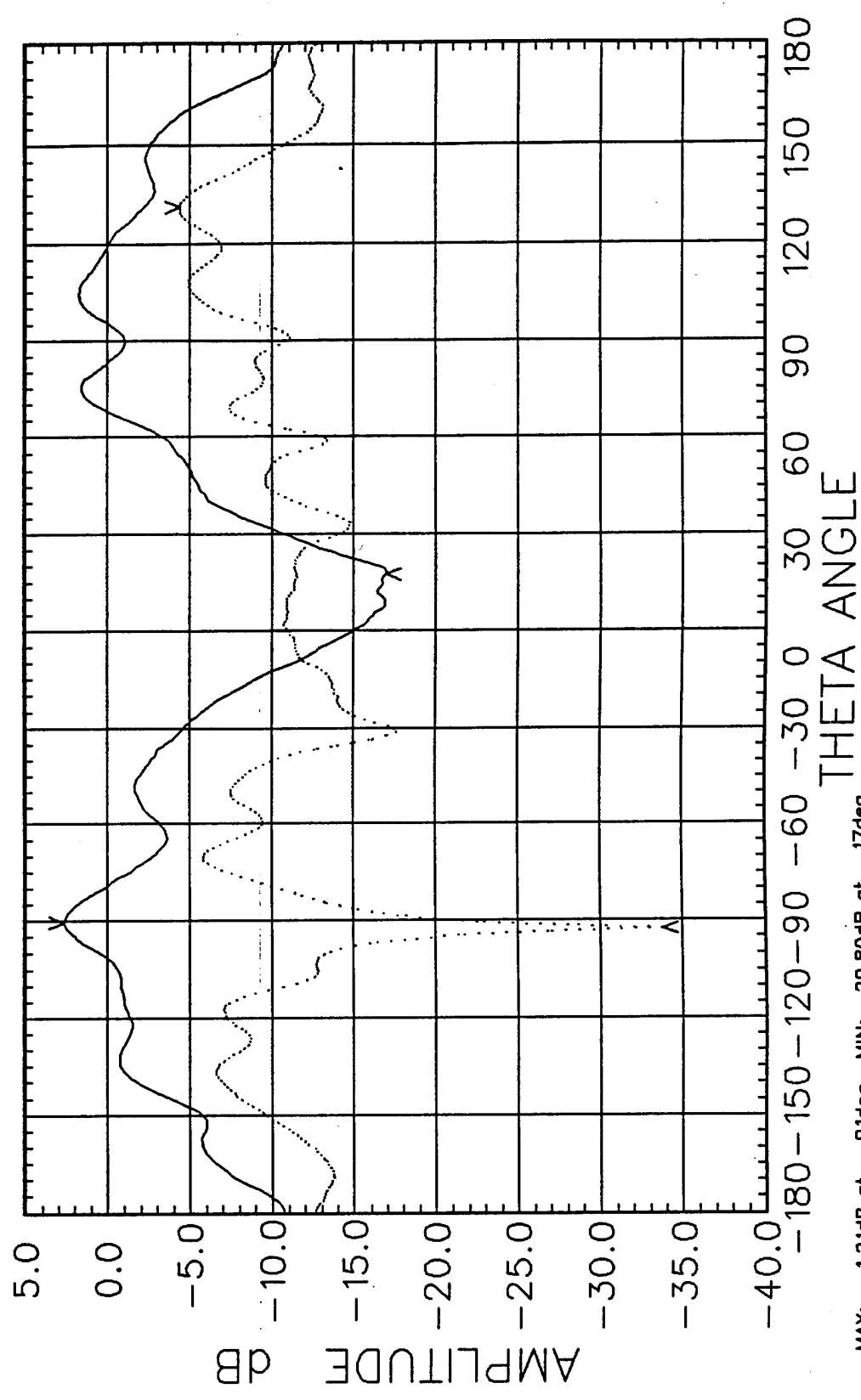
0deg NORMALIZED BY 4.80dB DF1282 HAS 0dB IF ATTEN SOURCE= 0deg V  
0deg NORMALIZED BY 5.26dB DF1292 HAS 0dB IF ATTEN SOURCE= 90deg H

BALL AEROSPACE



— MAX: -1.02dB at -87deg MIN: -29.45dB at 10deg  
..... MAX: -9.46dB at 106deg MIN: -36.60dB at -104deg

TAGGANT LETTER N BALL AEROSPACE  
 AZIMUTH 17 DEC 92  
 — is 900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 3.84dB DF1283 HAS 0dB IF ATTEN SOURCE= 0deg V  
 . . . is 900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 4.27dB DF1293 HAS 0dB IF ATTEN SOURCE= 90deg H



— MAX: -1.2dB at -91deg MIN: -20.80dB at 17deg  
 . . . MAX: -8.67dB at 131deg MIN: -38.09dB at -93deg

ELEVATION  
17 DEC 92

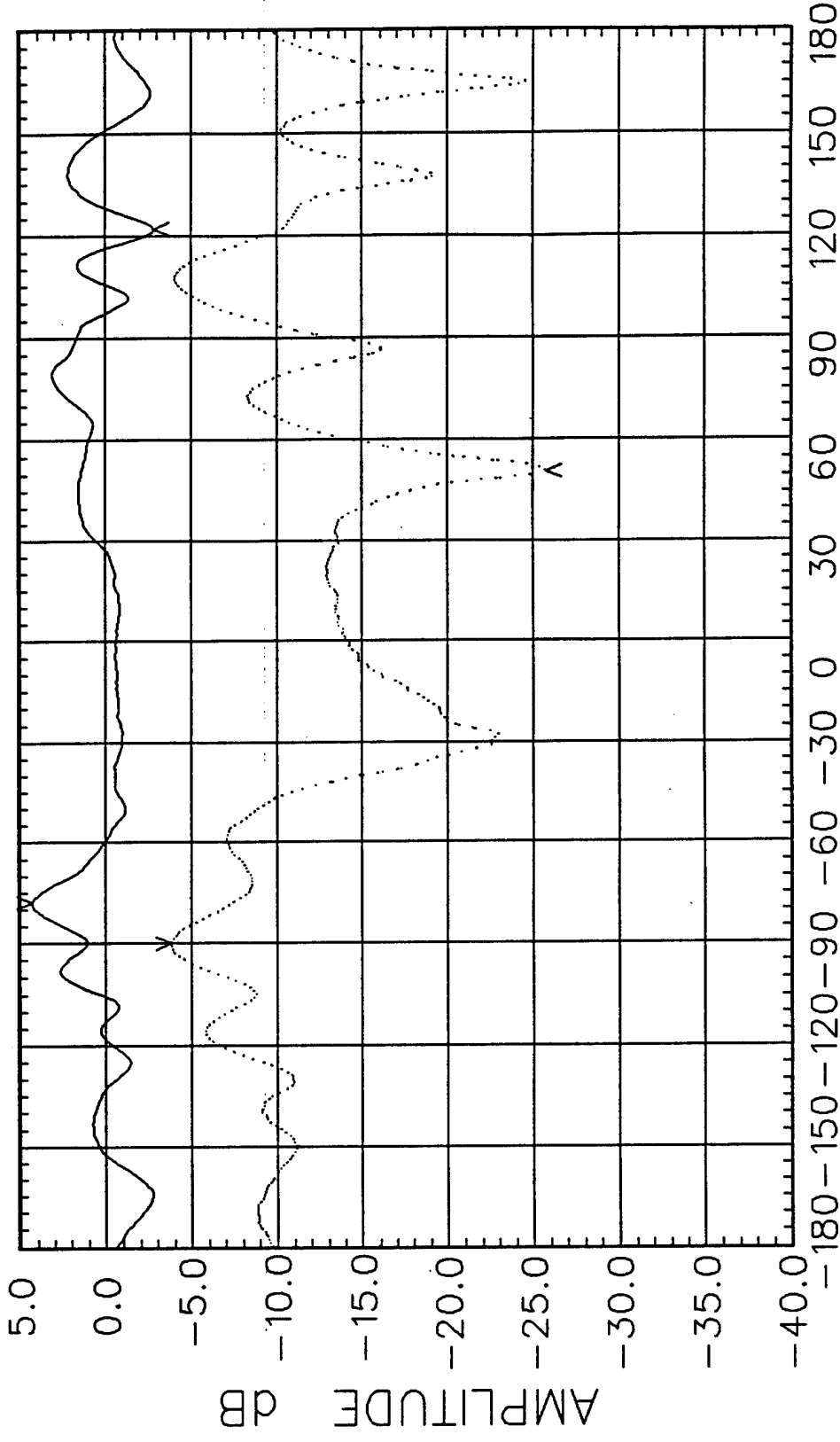
— is 860MHz A-AMPLITUDE PHI=  
.... is 860MHz A-AMPLITUDE PHI=

# TAGGANT LETTER N

0deg NORMALIZED BY 6.35dB DF1301 HAS 0dB IF ATTEN SOURCE= 90deg  
0deg NORMALIZED BY 5.84dB DF1311 HAS 0dB IF ATTEN SOURCE= 0deg

BALL AEROSPACE

2



— MAX: -2.09dB at -78deg MIN: -9.17dB at 122deg  
.... MAX: -9.65dB at -90deg MIN: -31.59dB at 51deg

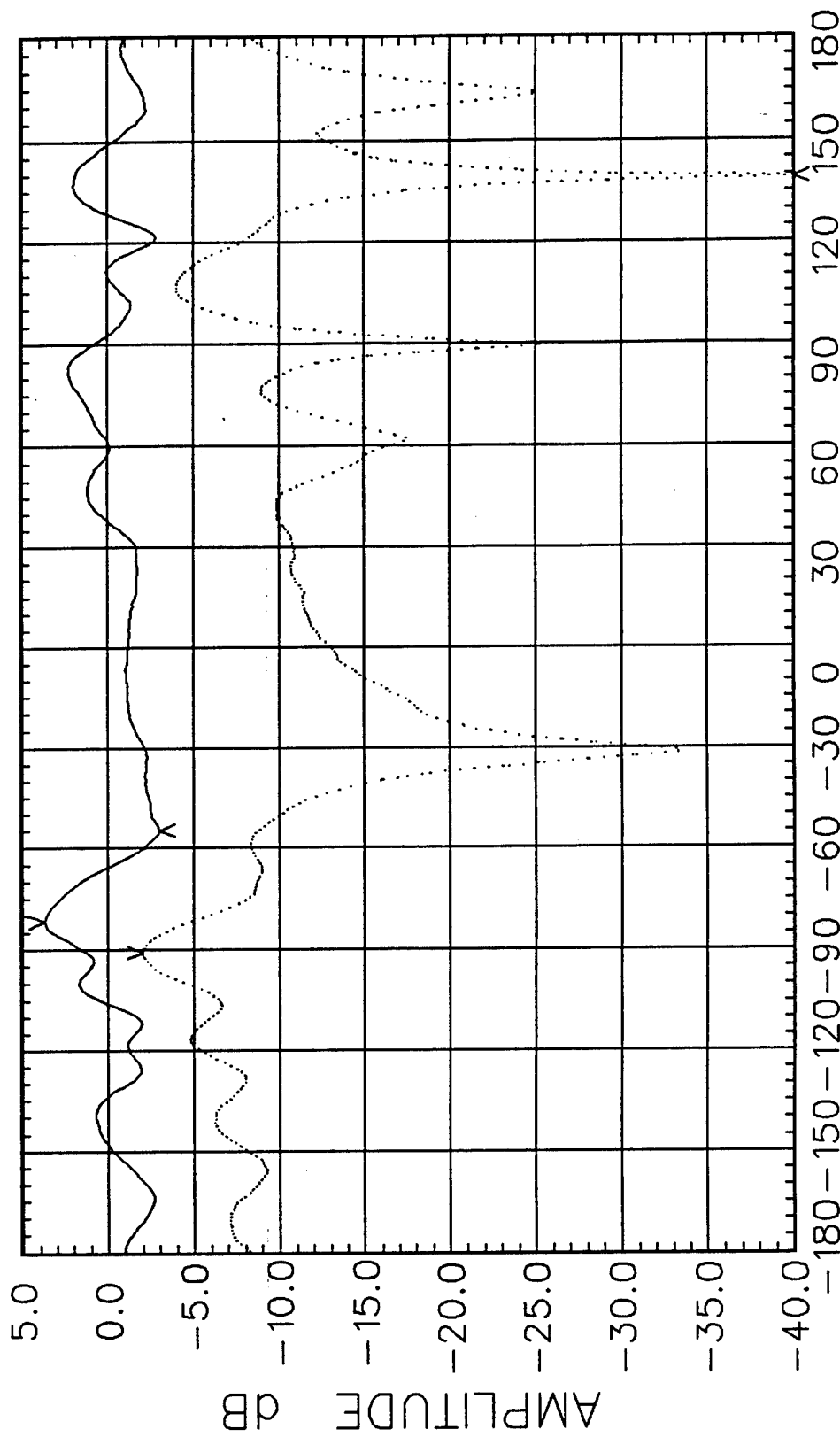
ELEVATION  
17 DEC 92

— is 880MHz A-AMPLITUDE PHI=  
.... is 880MHz A-AMPLITUDE PHI=

**TAGGANT LETTER N**  
0deg NORMALIZED BY 5.26dB DF1302 HAS 0dB IF ATTEN SOURCE=  
0deg NORMALIZED BY 4.80dB DF1312 HAS 0dB IF ATTEN SOURCE=

BALL AEROSPACE

90deg H  
0deg V



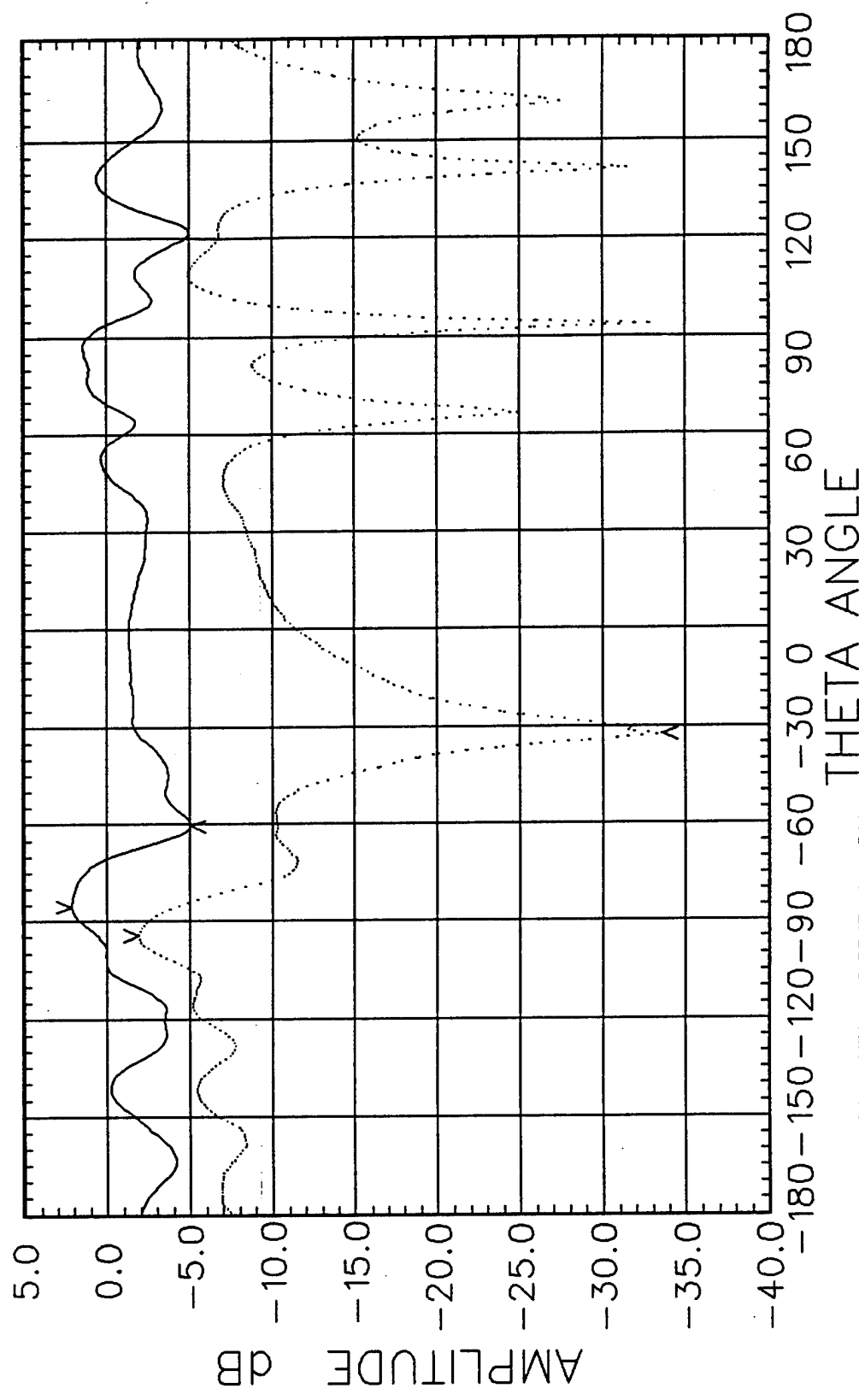
1) PLOT: 19 MAY 92  
2) PLOT: 19 MAY 92

ELEVATION  
17 DEC 92

BALL AEROSPACE

# TAGCANT LETTER N

900MHz A--AMPLITUDE PHI= 0deg NORMALIZED BY 4.27dB DF1303 HAS 0dB IF ATTEN SOURCE= 90deg H  
900MHz A--AMPLITUDE PHI= 0deg NORMALIZED BY 3.84dB DF1313 HAS 0dB IF ATTEN SOURCE= 0deg V



MAX: -2.16dB at -86deg MIN: -9.33dB at -61deg  
MAX: -5.78dB at -95deg MIN: -37.46dB at -33deg

2) RPL01:19 MAY 92

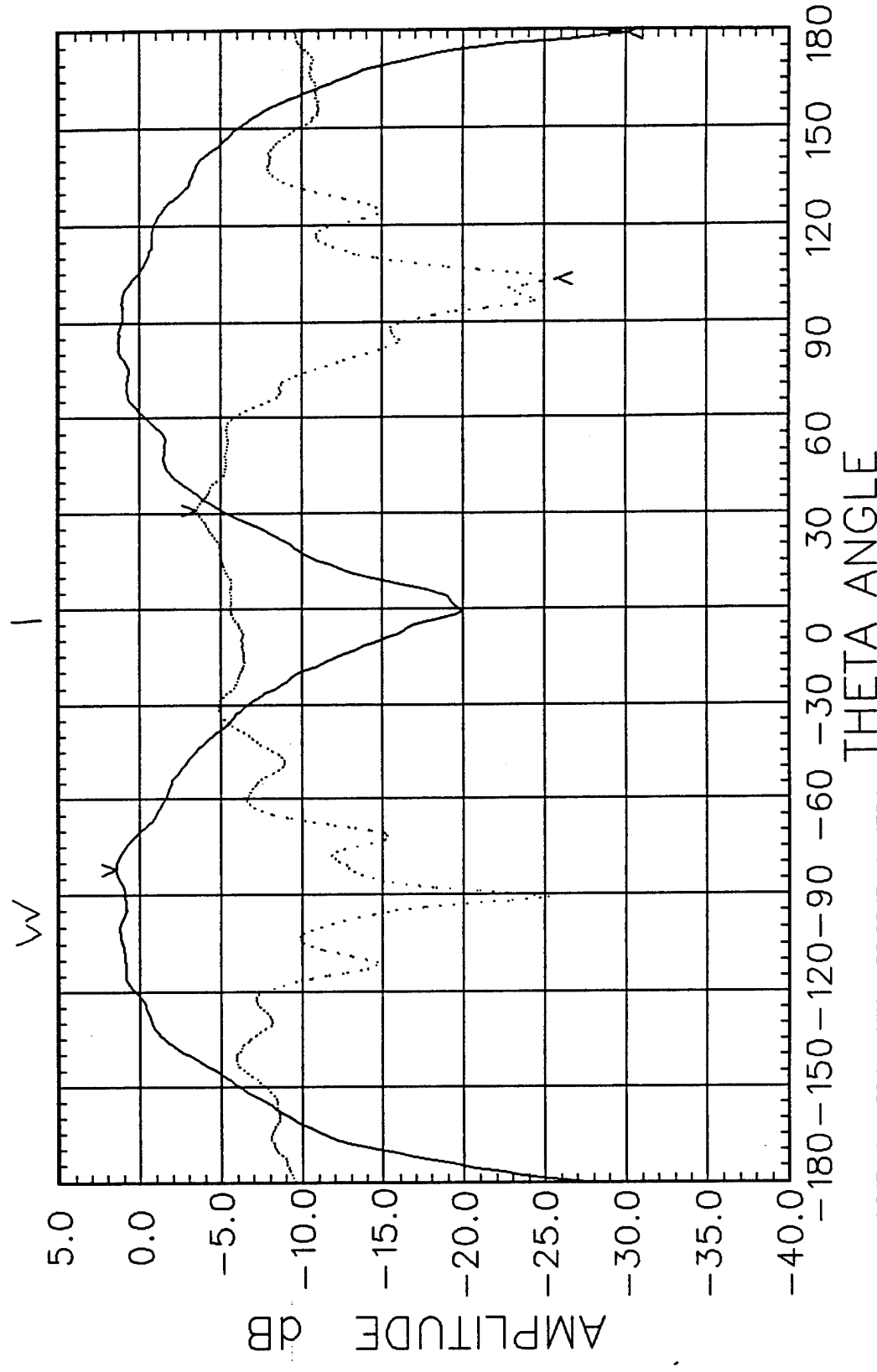
AZIMUTH  
17 DEC 92

— is 860MHz A-AMPLITUDE PHI=  
... is 860MHz A-AMPLITUDE PHI=

**TAGGANT LETTER W**  
0deg NORMALIZED BY 5.84dB DF1201 HAS 0dB IF ATTEN SOURCE=  
0deg NORMALIZED BY 6.35dB DF1211 HAS 0dB IF ATTEN SOURCE=

BALL AEROSPACE

0deg V  
90deg H



— MAX: -4.38dB at -82deg MIN: -36.00dB at 179deg  
... MAX: -9.85dB at 31deg MIN: -32.19dB at 103deg

1) RPL01:19 MAY 92  
2)



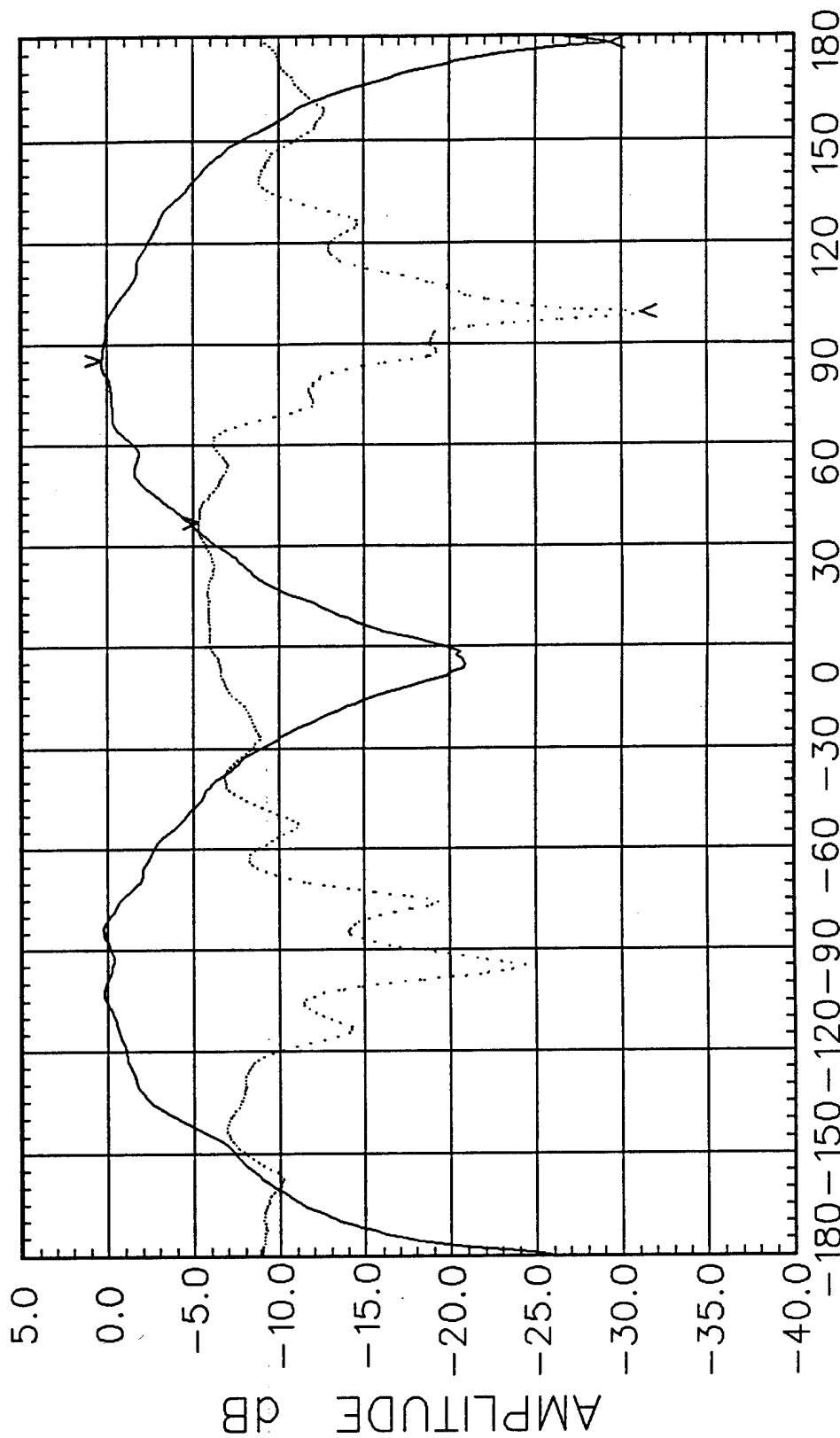
AZIMUTH  
17 DEC 92

— is 880MHz A-AMPLITUDE PHI=  
... is 880MHz A-AMPLITUDE PHI=

0deg NORMALIZED BY 4.80dB DF1202 HAS 0dB IF ATTEN SOURCE= 0deg V  
0deg NORMALIZED BY 5.26dB DF1212 HAS 0dB IF ATTEN SOURCE= 90deg H

BALL AEROSPACE

# TAGGANT LETTER W



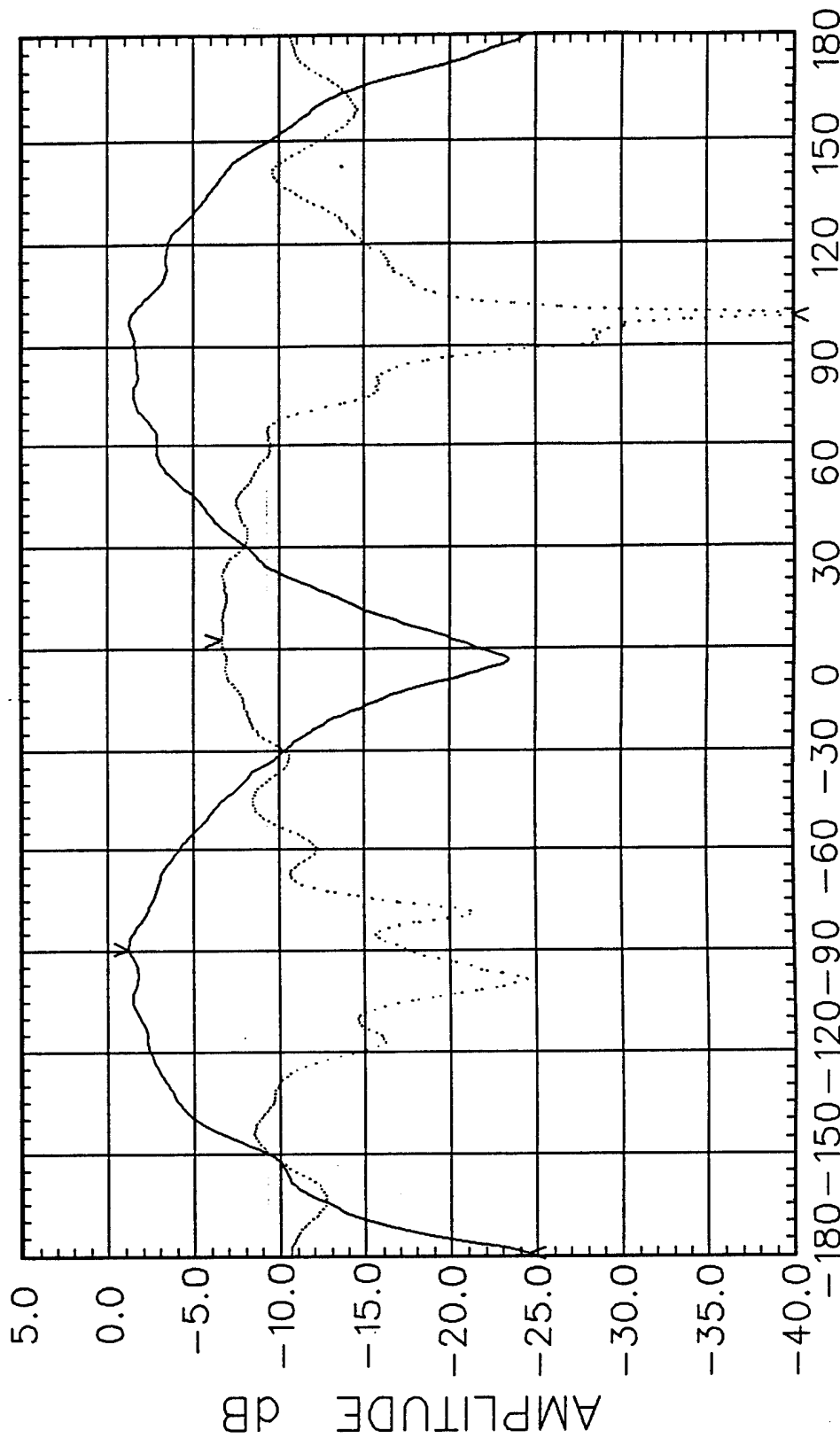
— MAX: -4.46dB at 85deg MIN: -34.13dB at 178deg  
... MAX: -10.56dB at 37deg MIN: -36.42dB at 99deg

AZIMUTH  
17 DEC 92

# TAGGANT LETTER W

BALL AEROSPACE

900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 3.84dB DF1203 HAS 0dB IF ATTEN SOURCE= 0deg V  
900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 4.27dB DF1213 HAS 0dB IF ATTEN SOURCE= 90deg u



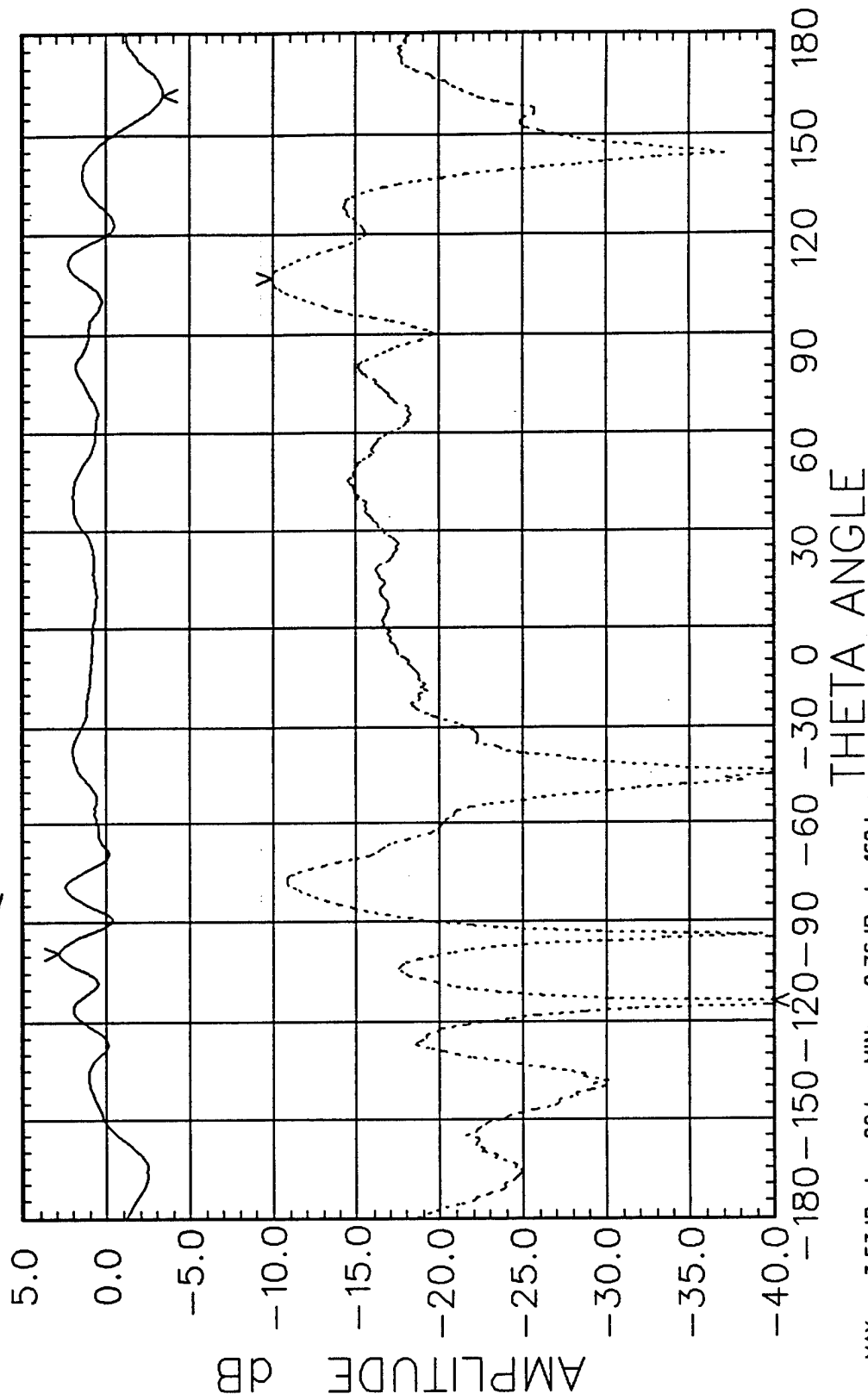
— MAX: -5.07dB at -90deg MIN: -28.41dB at -180deg  
.... MAX: -10.91dB at 3deg MIN: -45.32dB at 98deg

ELEVATION  
17 DEC 92

— is 860MHz A-AMPLITUDE PHI=  
..... is 860MHz A-AMPLITUDE PHI=

**TAGGANT LETTER W**  
0deg NORMALIZED BY 6.35dB DF1221 HAS 0dB IF ATTEN SOURCE= 90deg H  
0deg NORMALIZED BY 5.84dB DF1231 HAS 0dB IF ATTEN SOURCE= 0deg V

BALL AEROSPACE



— MAX: -3.53dB at -99deg MIN: -9.76dB at 162deg  
..... MAX: -15.78dB at 107deg MIN: -49.74dB at -114deg

1) RELOT: 19 MAY 92  
2)

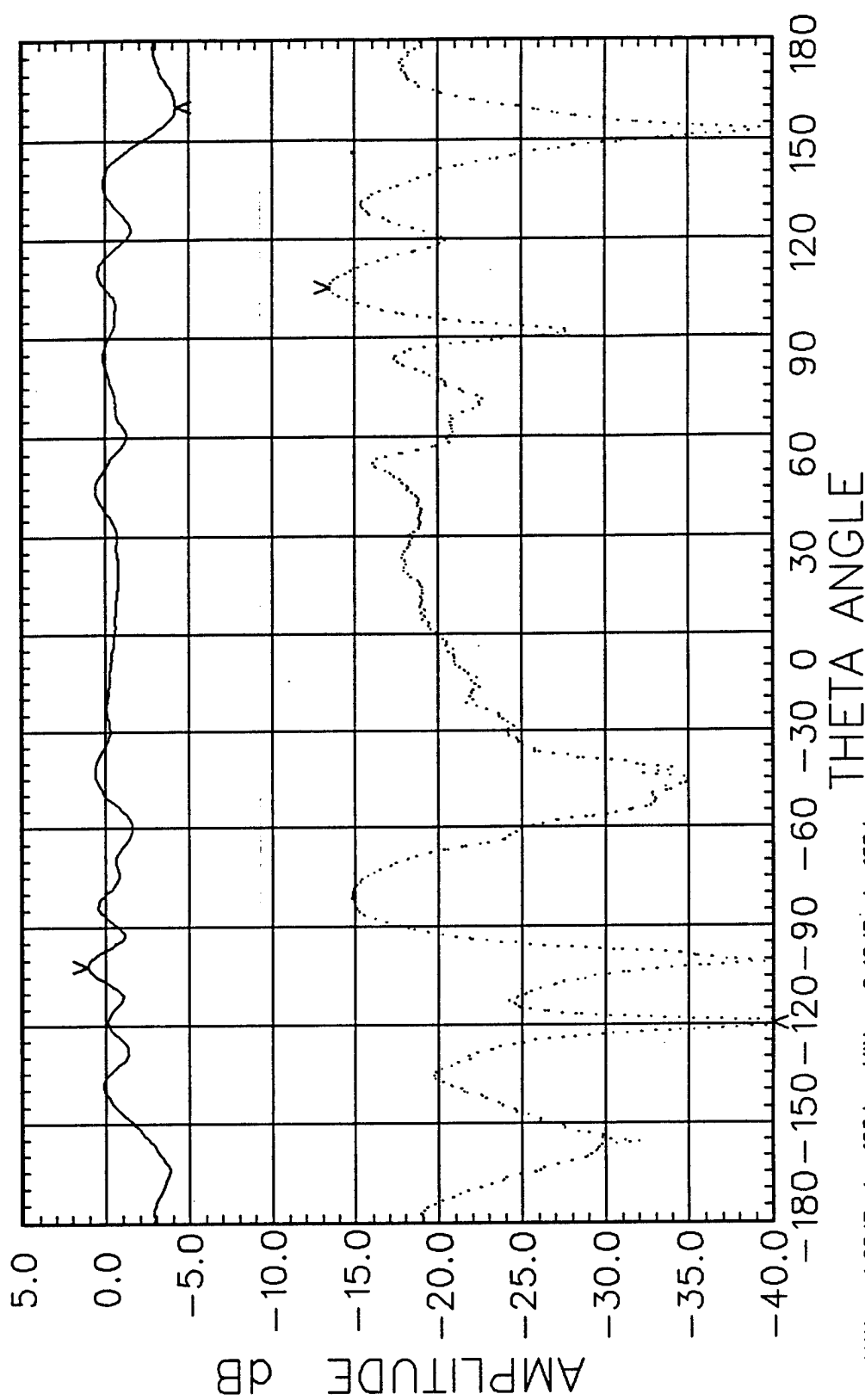
ELEVATION  
17 DEC 92

— is 880MHz A-AMPLITUDE PHI=  
..... is 880MHz A-AMPLITUDE PHI=

# TAGGANT LETTER W

BALL AEROSPACE

0deg NORMALIZED BY 5.26dB DF1222 HAS 0dB IF ATTEN SOURCE= 90deg H  
0deg NORMALIZED BY 4.80dB DF1232 HAS 0dB IF ATTEN SOURCE= 0deg V



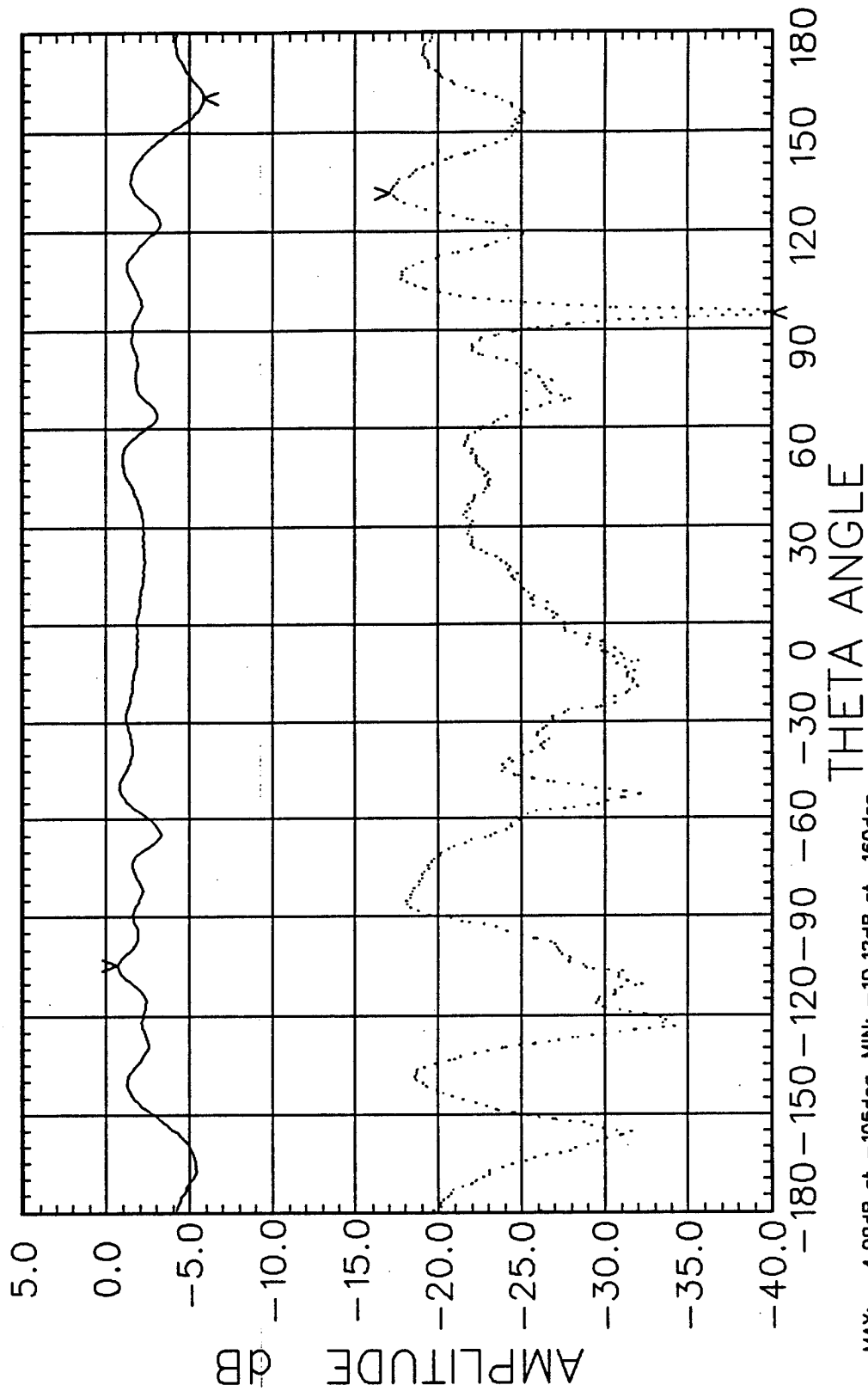
— MAX: -4.20dB at -102deg MIN: -9.49dB at 160deg  
..... MAX: -18.27dB at 105deg MIN: -58.43dB at -120deg

ELEVATION  
17 DEC 92

BALL AEROSPACE

# TAGGANT LETTER W

— is 900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 4.27dB DF1223 HAS 0dB IF ATTEN SOURCE= 90deg H  
.... is 900MHz A-AMPLITUDE PHI= 0deg NORMALIZED BY 3.84dB DF1233 HAS 0dB IF ATTEN SOURCE= 0deg V



— MAX: -4.99dB at -105deg MIN: -10.12dB at 160deg  
.... MAX: -20.91dB at 131deg MIN: -46.09dB at 94deg

1 RPT01:19 MAY 92  
2 RPT01:19 MAY 92

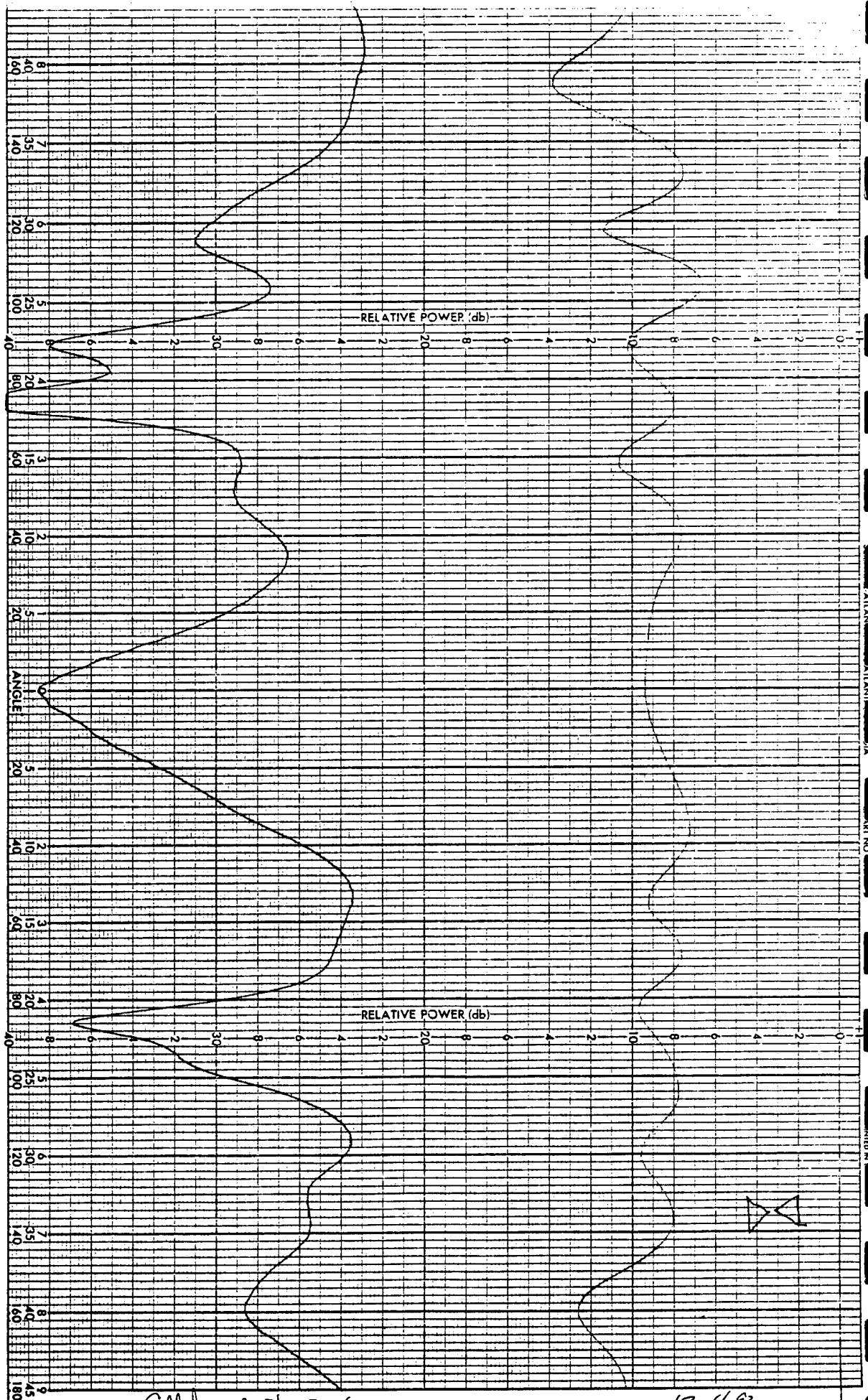


## **Appendix II**

### **Argos Bowtle Antenna**

Arco 401 MLE 90° Bowtie Antenna

Freq	SG LPDA on channel	Oct Bandwidth	H	Gain (dBil) V
391	-3.0	-11.0	+2.2	-10.8
401	-2.4	-10.4	+1.5	-10.6
411	-2.8	-10.8	+1.6	-10.7



PROJECT  
REMARKS

Cellular 90° Bowtie  
890 MHz

ENGR

BI/Hor

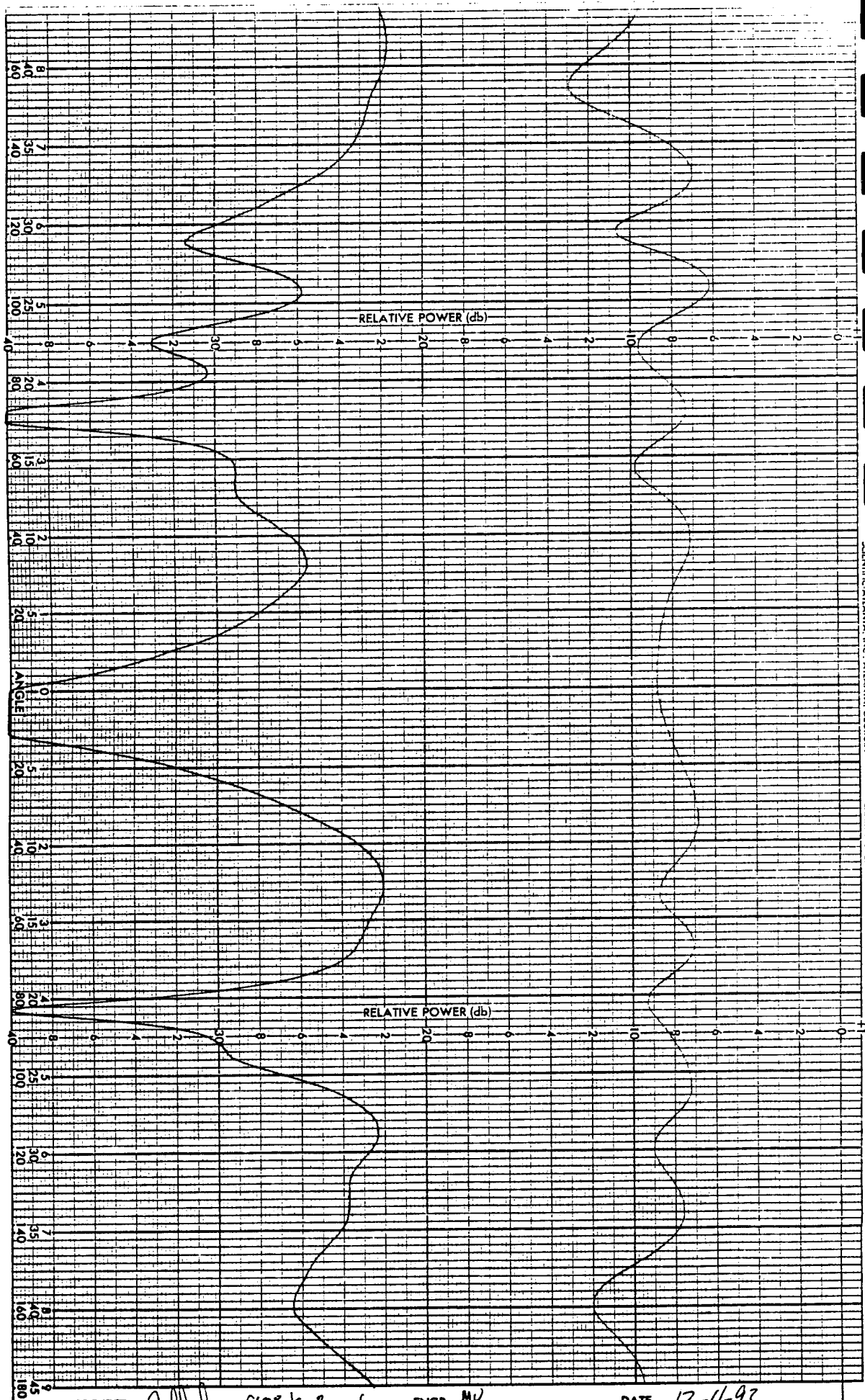
DATE

12-11-92

A=10

106743





PROJECT  
REMARKS

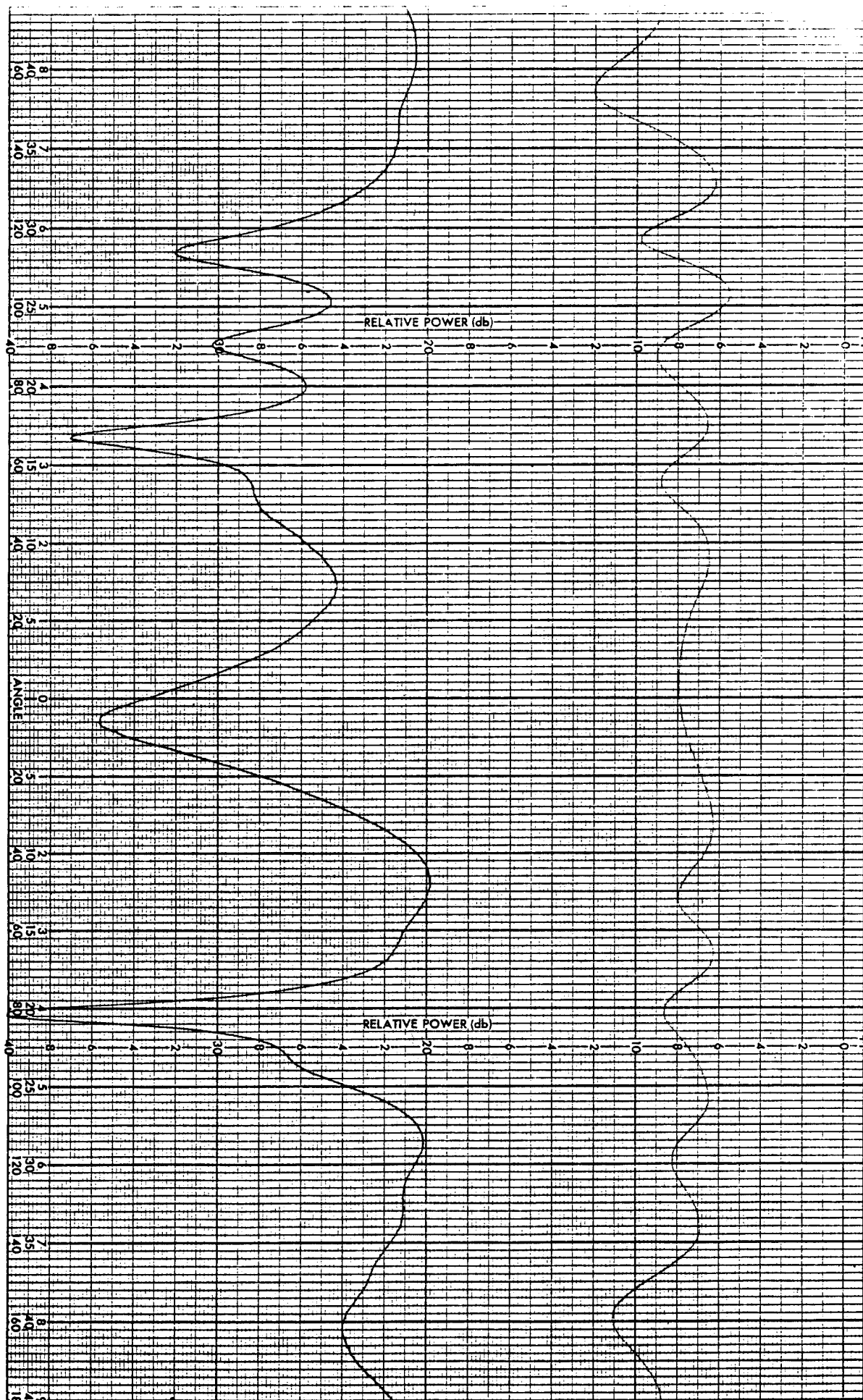
Cellular 90° & Bowtie  
880 MHz

ENGR MU

B1 = H<sub>0</sub>

DATE 12-11-92

A-10 106744



PROJECT  
REMARKS

Cellular 90° & Bowtie  
870 MHz

ENGR

M<sup>o</sup>

Bl = Hon

DATE

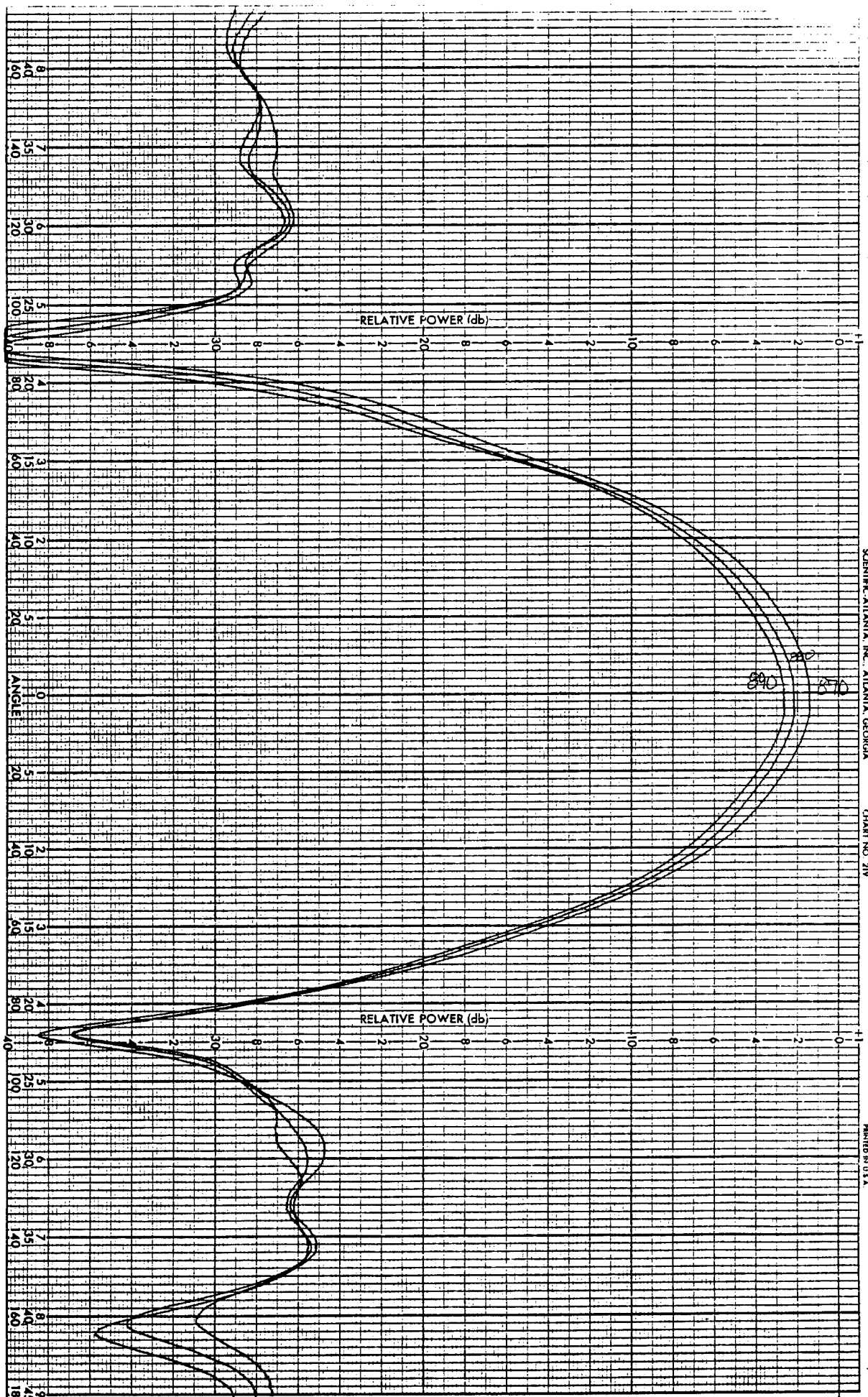
12-11-92

A=10 106745

CELLULAR ATLANTA, INC. ATLANTA, GEORGIA

DRAW NO. 219

REVISED BY J.S.A.



SCIENTIFIC ATLANTA, INC. ATLANTA, GEORGIA

CHART NO. 219

PRINTED IN U.S.A.

PROJECT  
REMARKS

ENGR

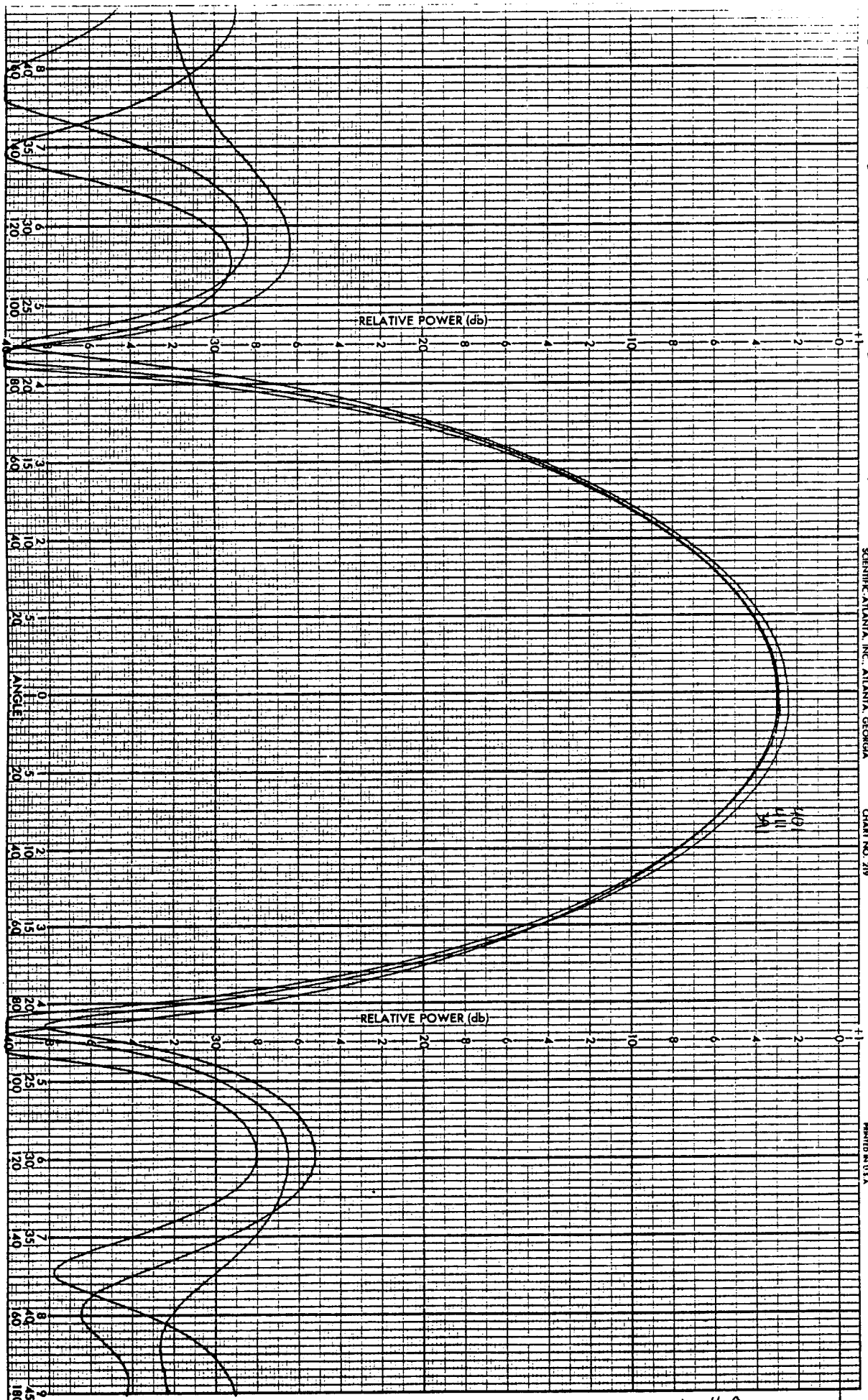
+18.0db

DATE

12-11-92

Post ~~Alpha~~ Cross Log Coars

A=0 106746



SCIENTIFIC ATLANTA, INC. ATLANTA, GEORGIA  
CHART NO. 18

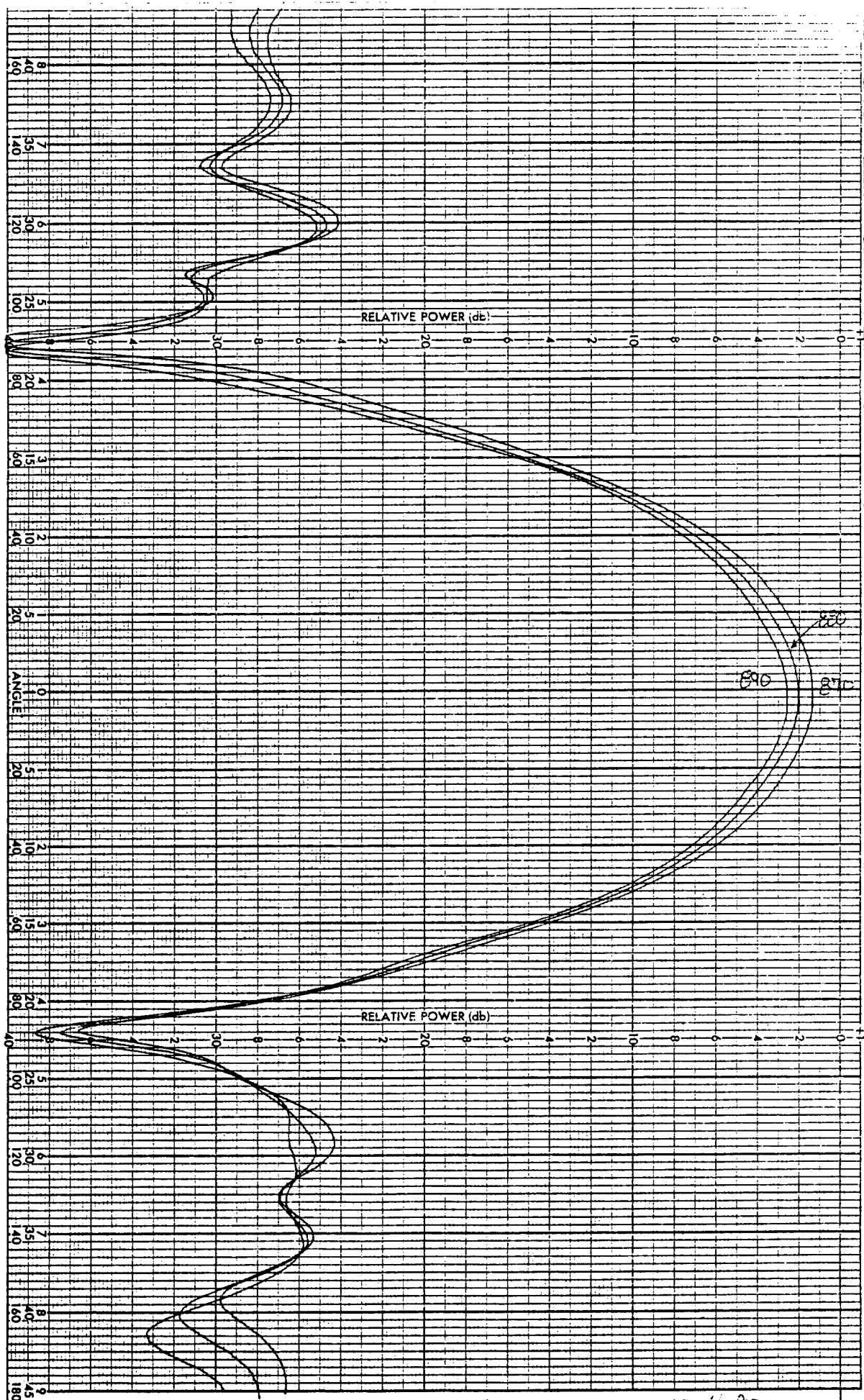
PROJECT  
REMARKS

ENGR

DATE 12-11-92

Post Cross Coa Crains

106747



PROJECT  
REMARKS

Cellular

ENGR

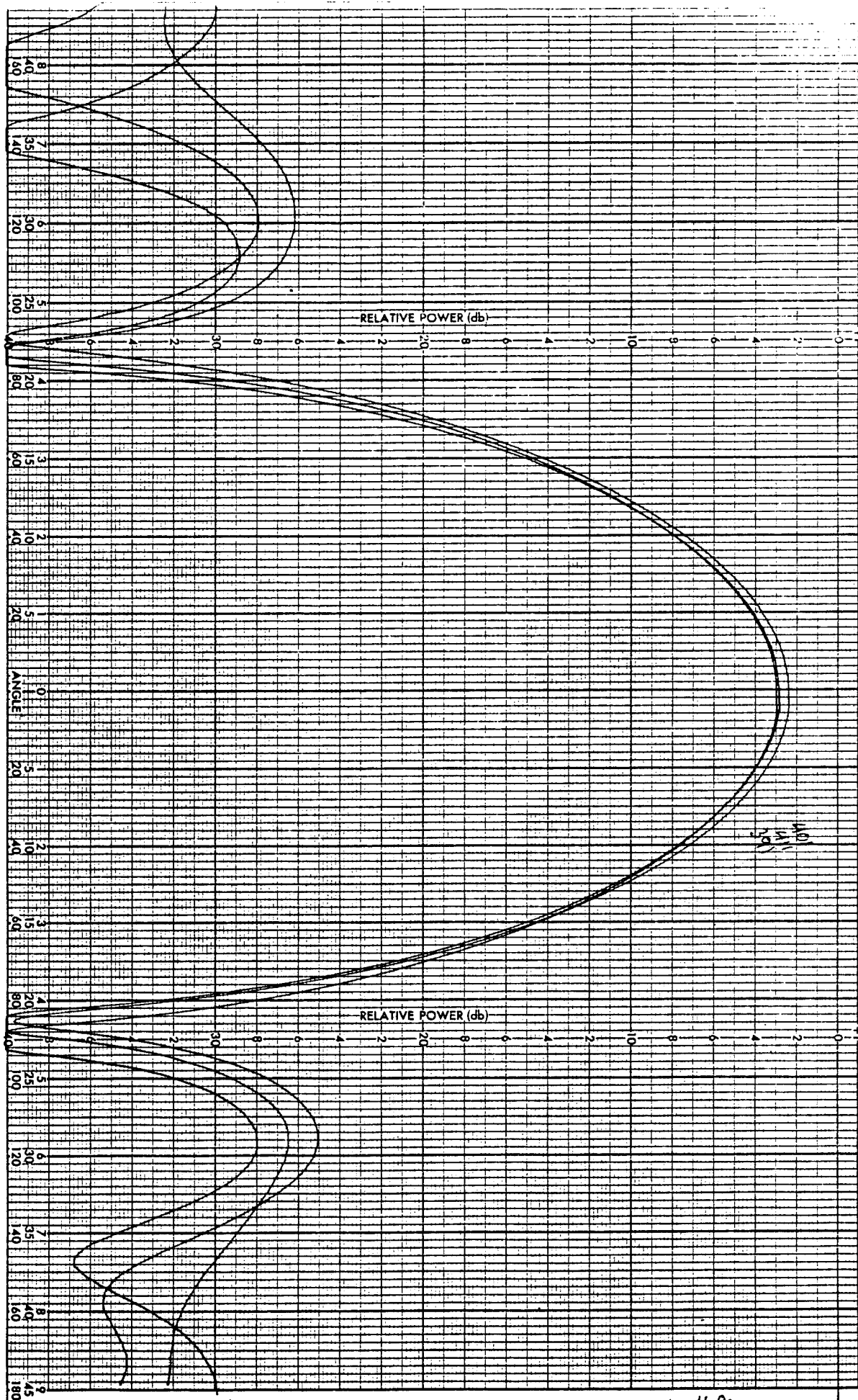
Hbr.

DATE

12-11-92

107159





SCIENTIFIC ATLANTA, INC., ATLANTA, GEORGIA  
 PRINTED IN U.S.A.  
 CHART NO. 20

PROJECT  
 REMARKS

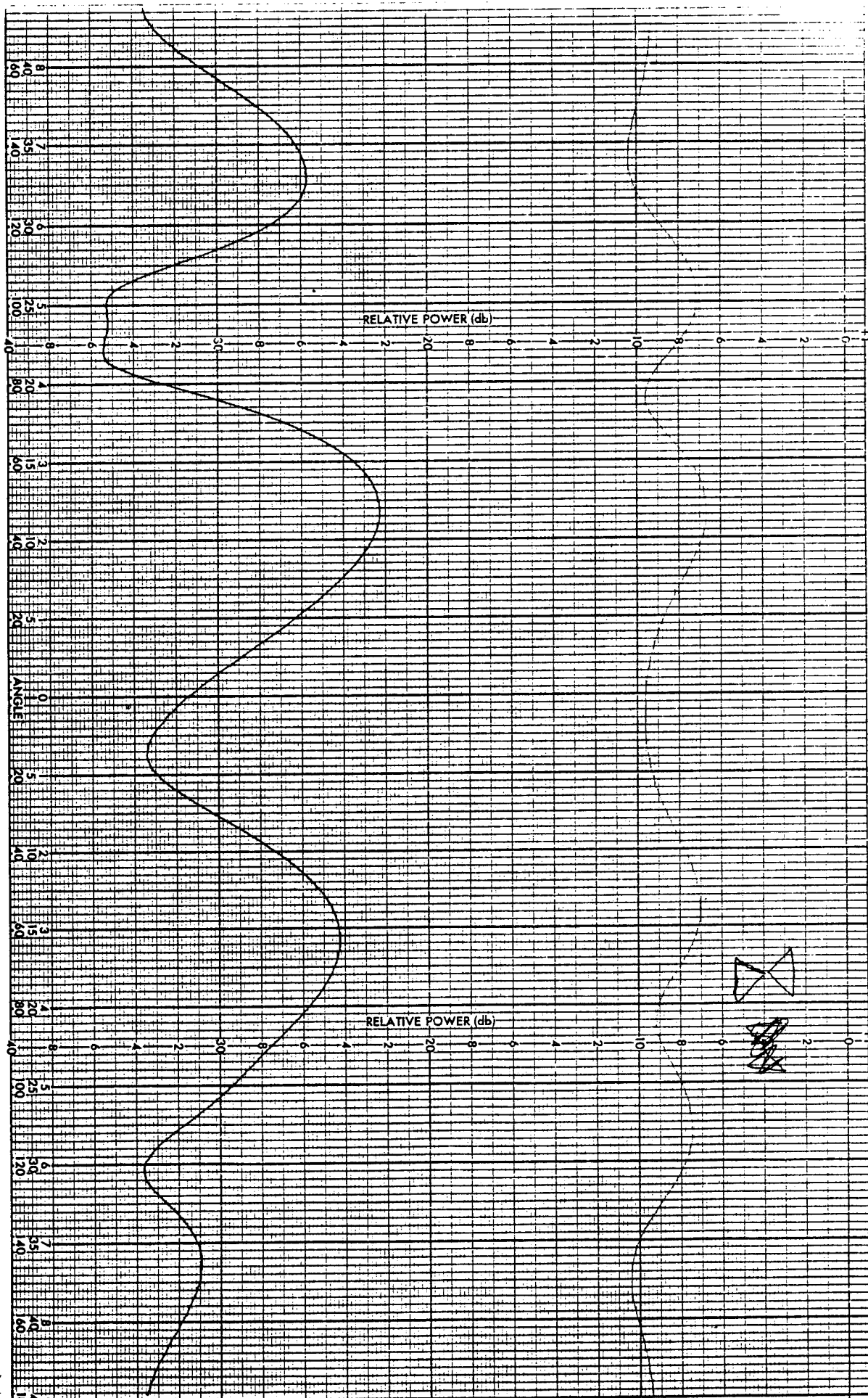
Argos  
 Cross 122 std Grain

ENGR

Hon

DATE 12-11-92

4-20 107161



SCIENTIFIC ATLANTA, INC., ATLANTA, GEORGIA

CHART NO. 219

REVISED N.E.T.A.

PROJECT  
REMARKS

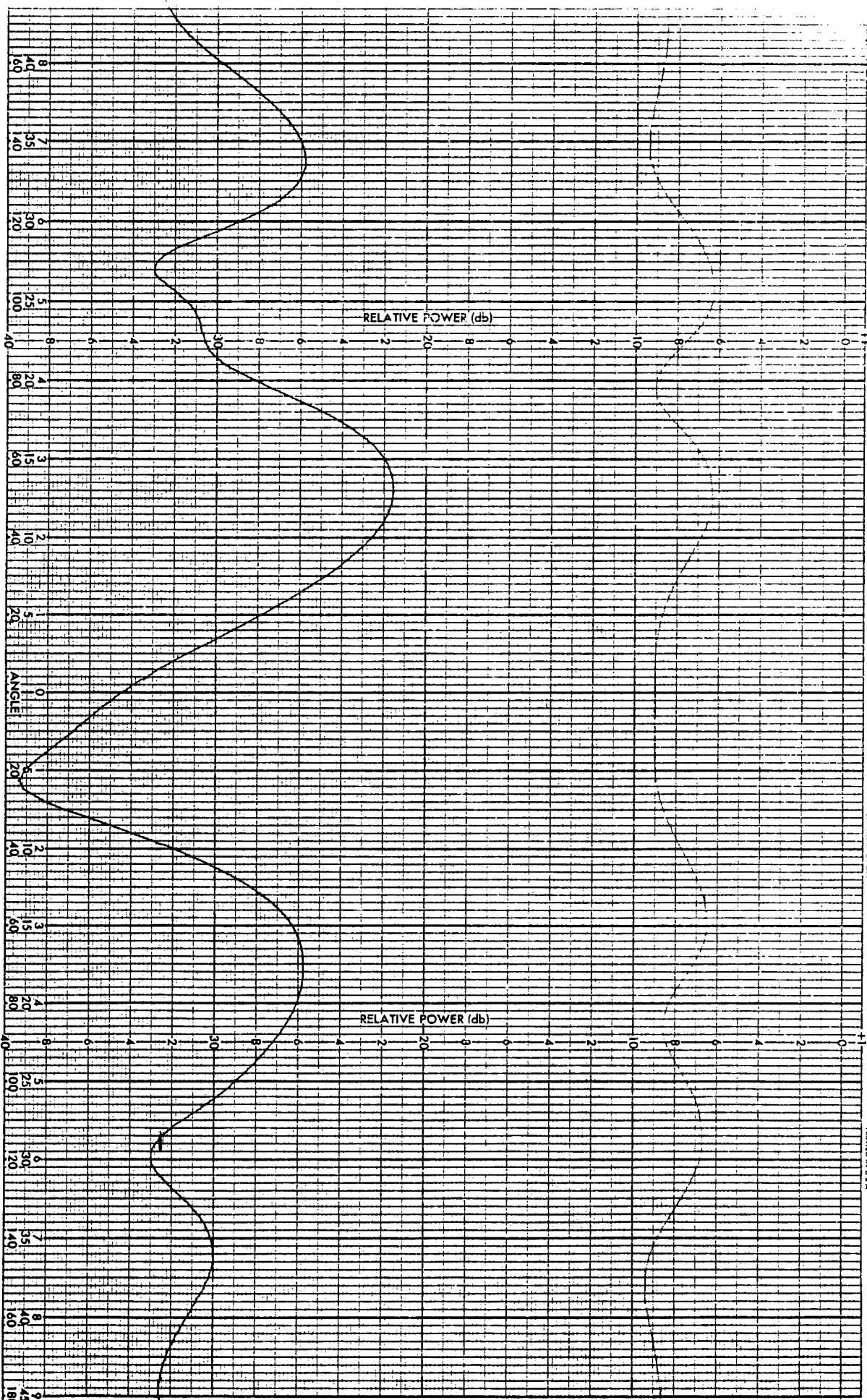
Argos 90° & Dototire  
391MHz

ENGR

B1=Hr

DATE 12-11-92

A=20 107162



PROJECT  
REMARKS

Argos 90° X Dowtie  
401Mh

ENGR

B1=40

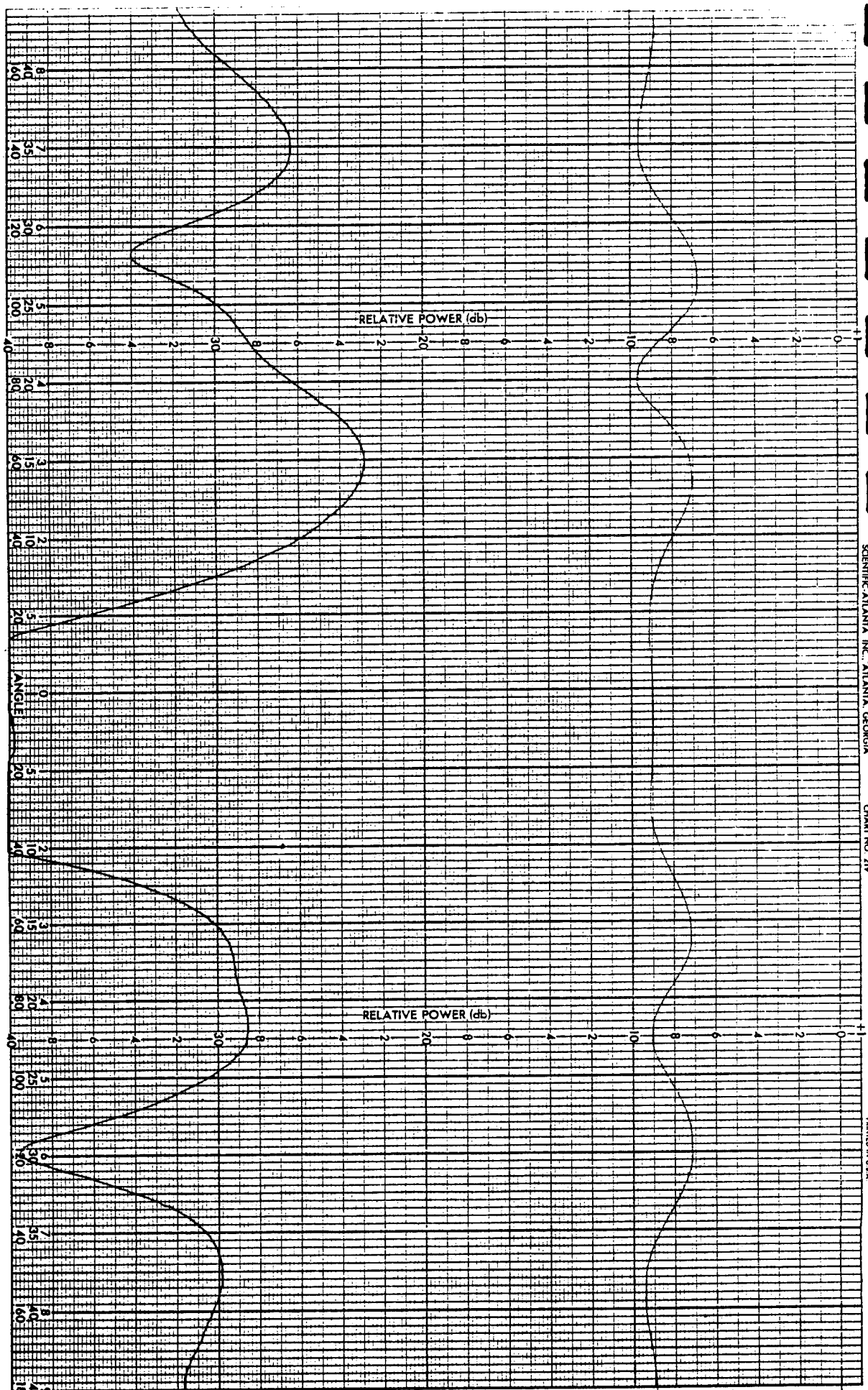
DATE

12-11-96

A=20

107163





PROJECT  
REMARKS

Argos 90° X Bowtie  
411 MHz

ENGR

BI-Hen

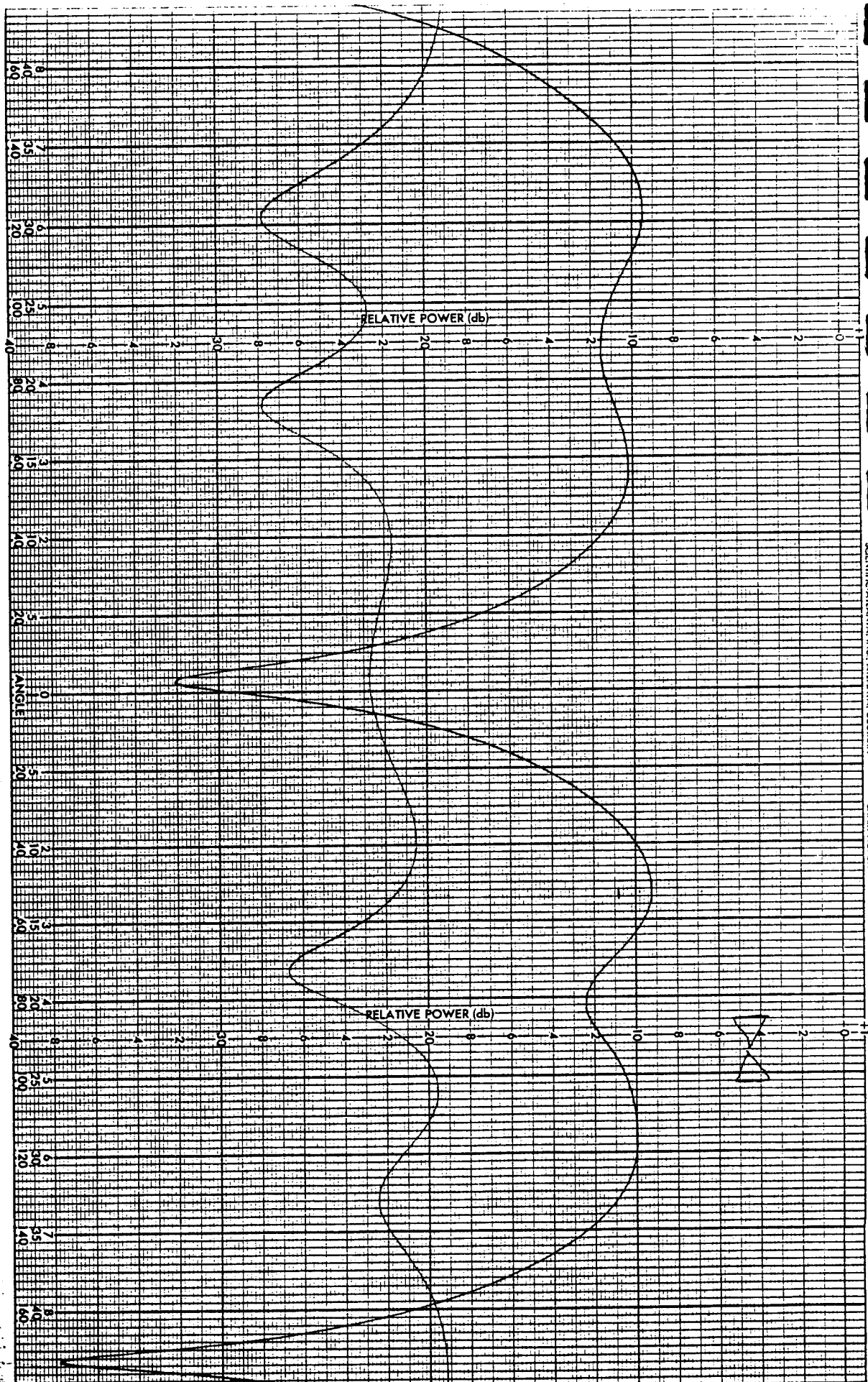
DATE

12-11-92

A=20

107164

SCIENTIFIC ATLANTA, INC., ATLANTA, GEORGIA  
DRAWING NO. 107164  
PRINTED IN U.S.A.



PROJECT  
REMARKS

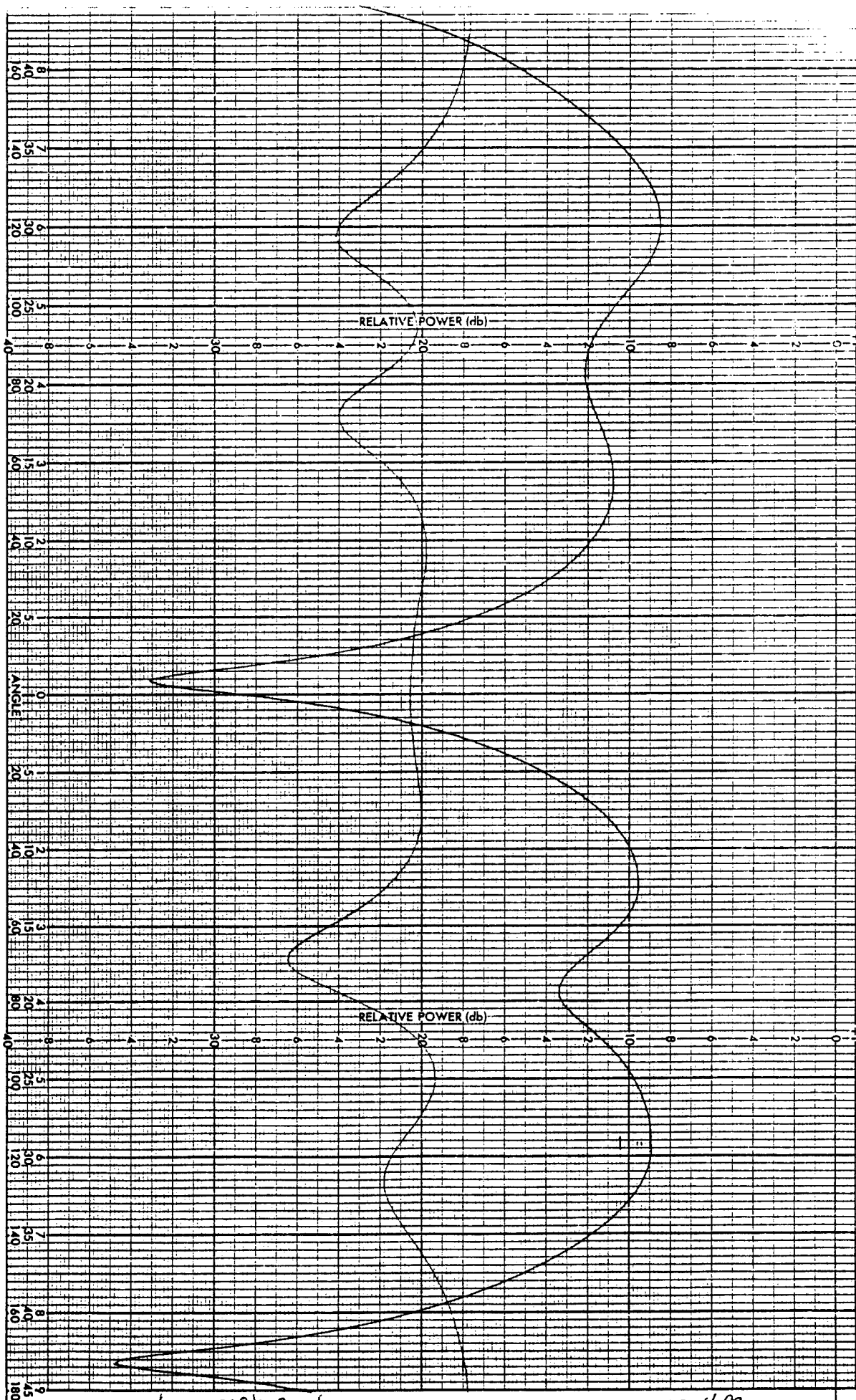
Argos 90° & Bowtre  
411MHz

ENGR

B1-Hor

DATE 12-11-92

A=20 107165



PROJECT  
REMARKS

Argos 90° Bowtie  
40MHz

ENGR

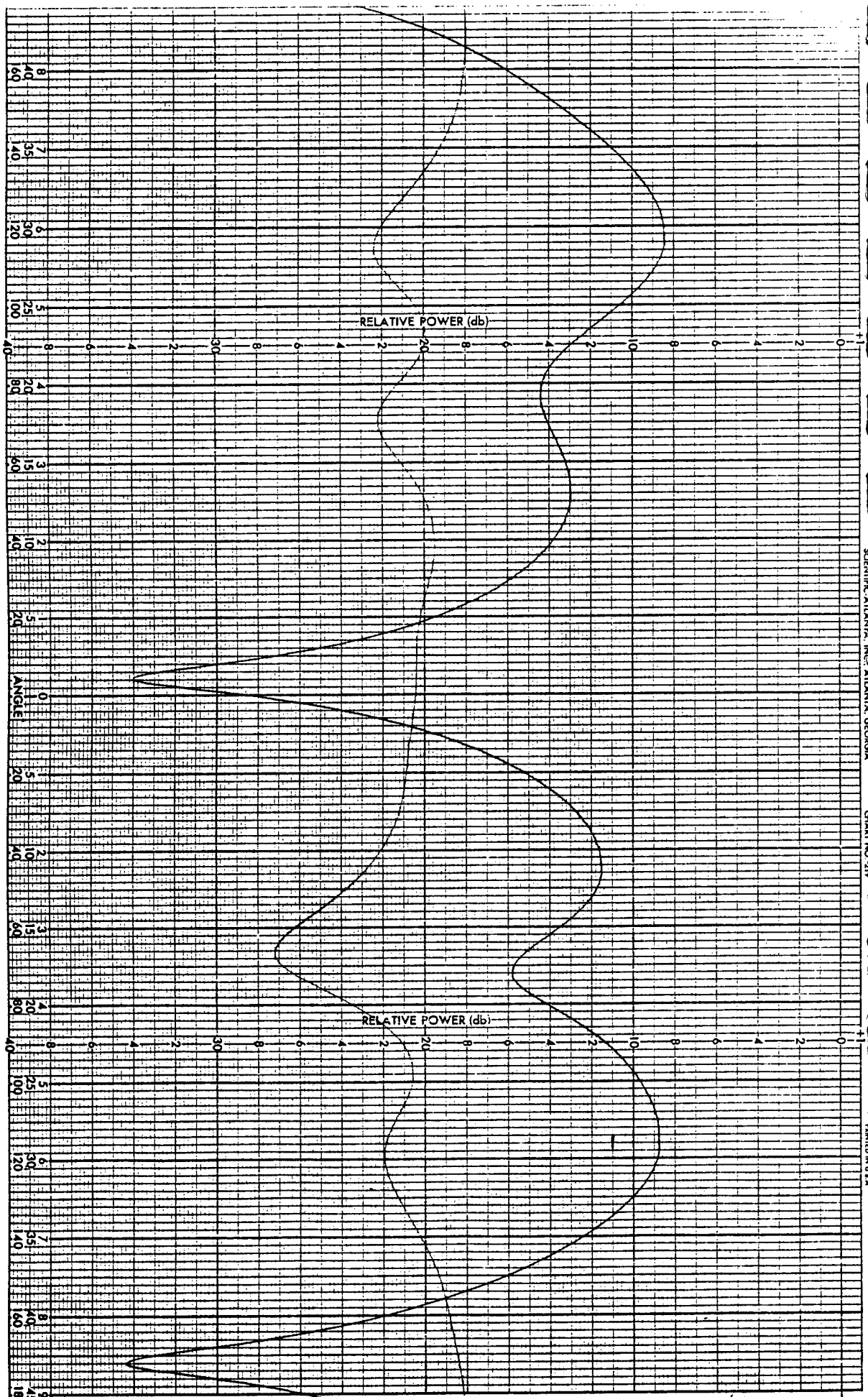
B/-Hm

DATE

12-11-92

A=20

107166



PROJECT  
REMARKS

Argos 90° & Douthie  
391MAR

ENGR

D1=1/10

DATE 12-11-92

107167

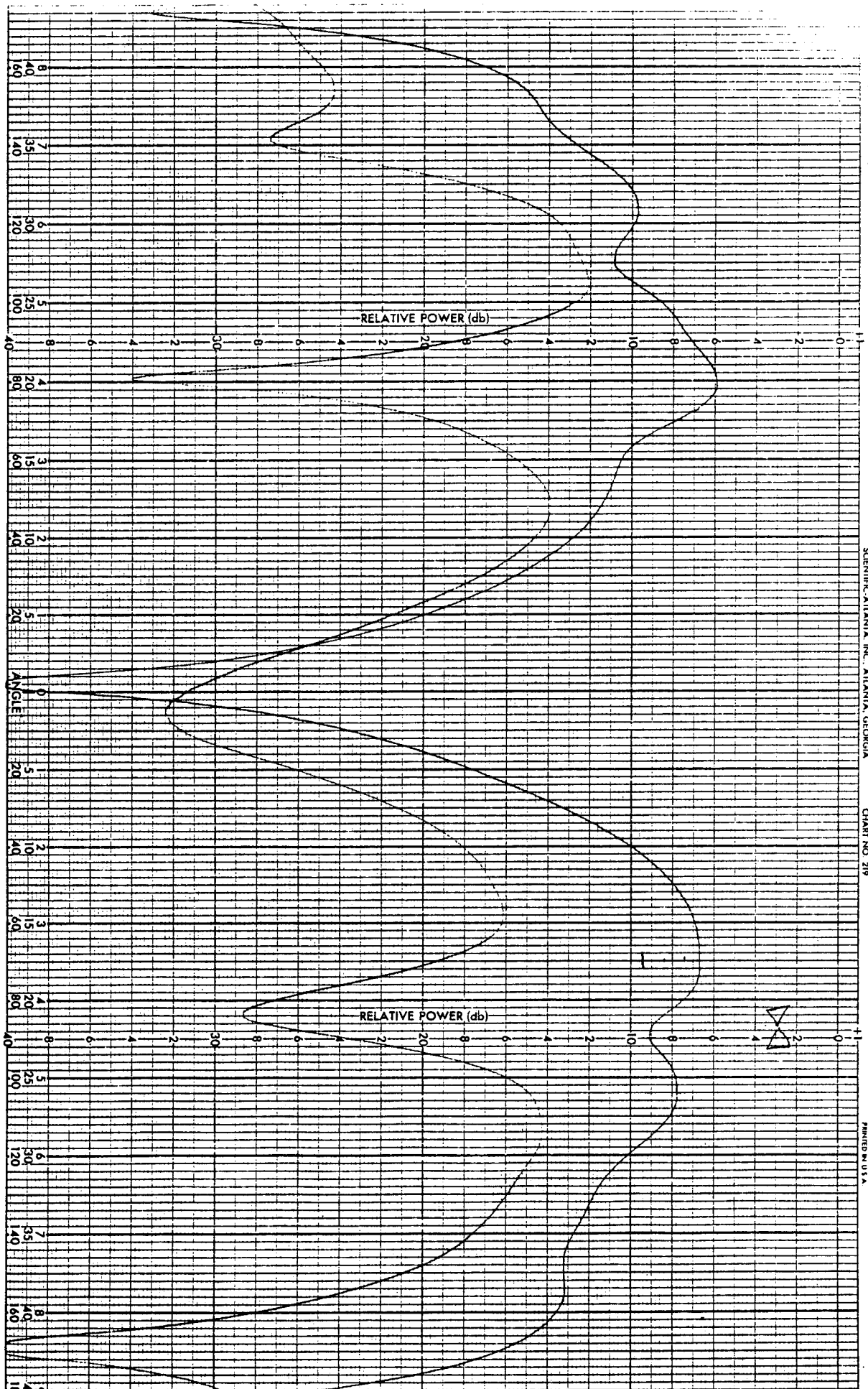


### **Appendix III**

#### **Cellular Bowtie Antenna**

# Cellular 90° Point Antennas

Freq	SGH LPDA on chart	OdB on chart	H	Gain (dBi) V
870	-1.4	-9.4	+2.7	-9.8
880	-2.2	-10.2	+3.0	-9.8
890	-2.6	-10.6	+3.0	-9.4



PROJECT  
REMARKS

Cellular 90° Bowtie  
870 MHz

ENGR

BI-Hor

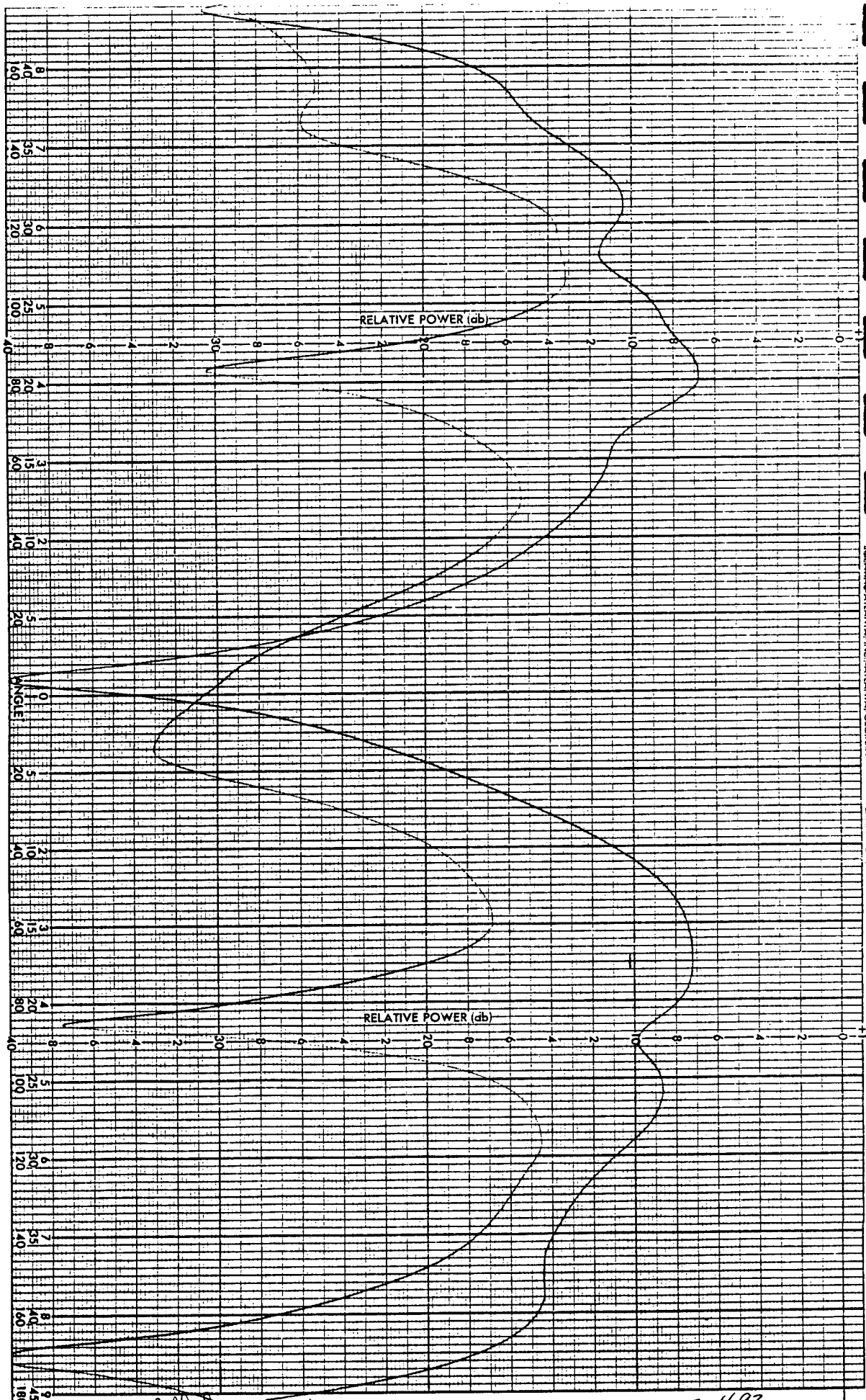
DATE

12-11-92

A-10

107168





PROJECT  
REMARKS

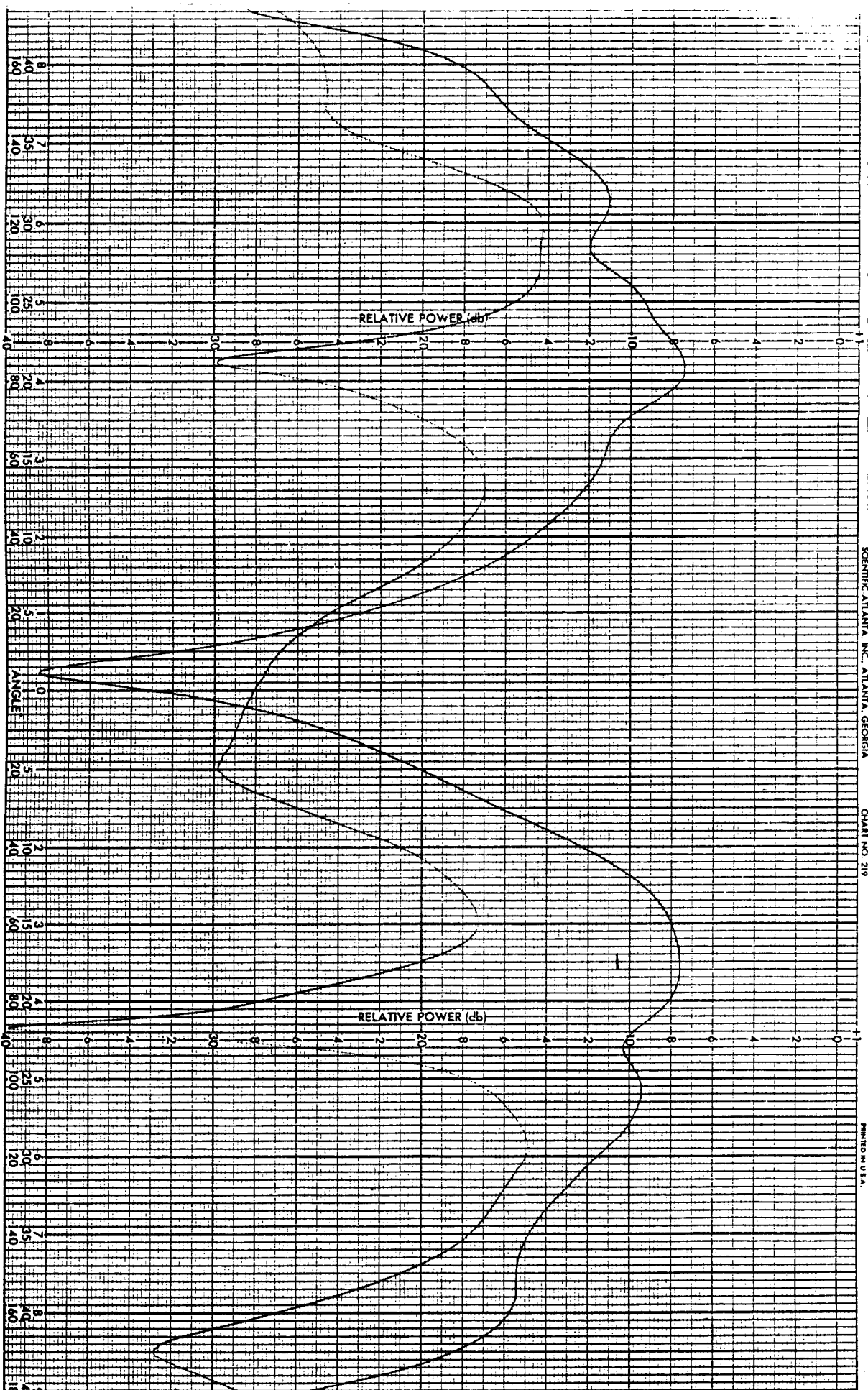
Cellular 90° & Bowtie ENGR  
880 MHz

B1-Hm

DATE 12-11-92

A=10 107169





SCIENTIFIC ATLANTA, INC. ATLANTA, GEORGIA CHART NO. 219

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PROJECT  
REMARKS

Cellular 90° & Bentie  
890MHz

ENGR

D/1-Hen

DATE 12-11-92

A-10 107170



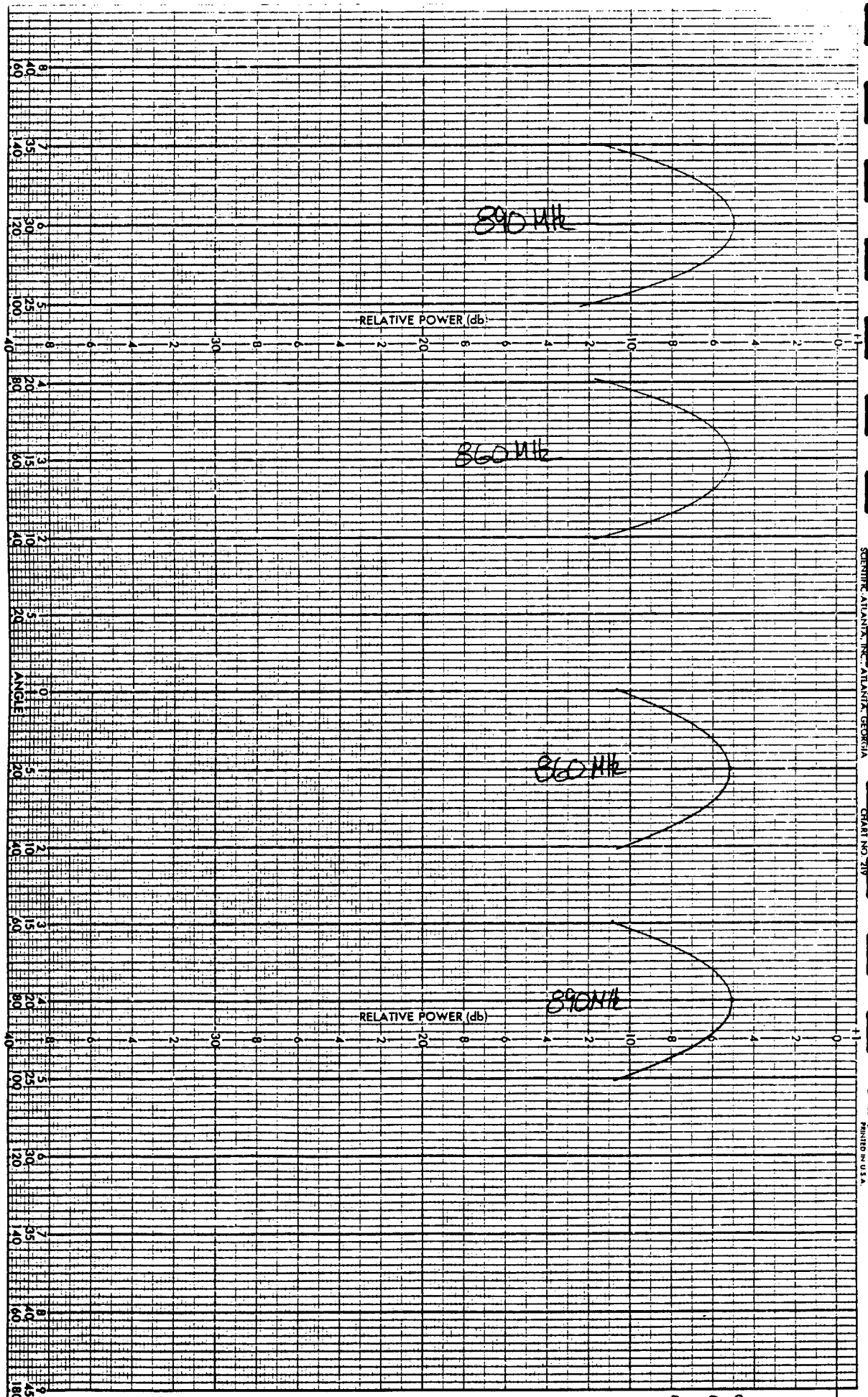
#### **Appendix IV**

#### **Cellular Bent Monopole Antenna**

Freq	SGH dBIC	SGH measured		OdBIC on chart		EQ 0° gain		AZ	0° gain
		Hor	Ver	Hor	Ver	Hor	Ver		
860	15.4	-5.3	-5.2	-10.7	-10.6	-25.1	3.15	3.20	-24.6
890	15.7	-5.15	-5.1	-10.85	-10.8	-24.05	2.15	2.25	-24.5

Cellular Base Tie (30°)

Freq	SGH dBIC	SGH measured		OdBIC on chart		EQ 0° gain		AZ 90° gain	
		Hor	Ver	Hor	Ver	Hor	Ver	Hor	Ver
860	15.4	-5.3	-5.2	-10.7	-10.6	-28.10	+1.65	1.30	-19.7
890	15.7	-5.15	-5.1	-10.85	-10.8	-23.05	+7.75	1.20	-18.0



DESIGNED BY ATLANTA, INC. ATLANTA, GEORGIA  
 CHART NO. 219  
 PRINTED IN U.S.A.

PROJECT  
 REMARKS

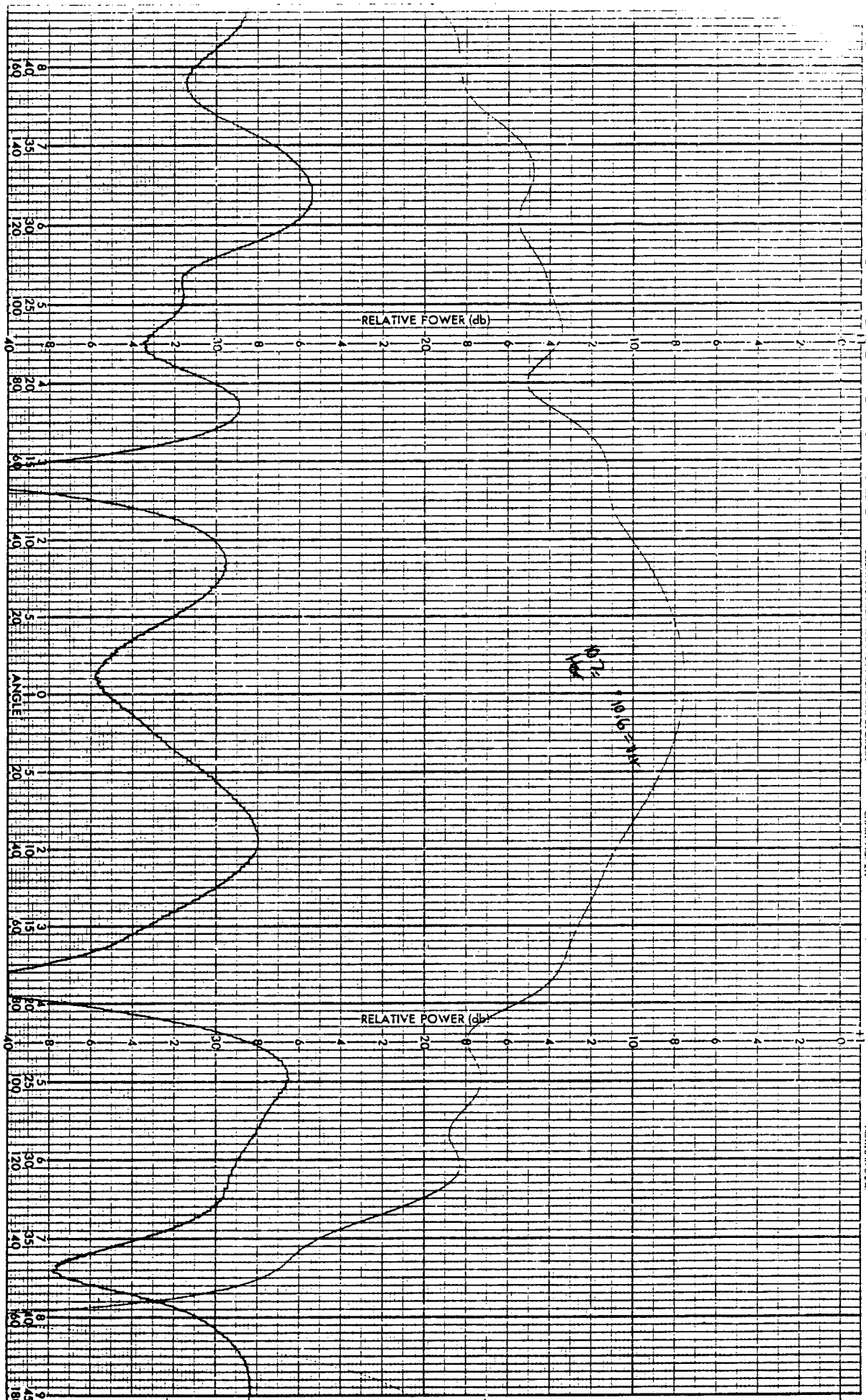
ENGR

DATE 10-28-91

Std Power 175 Worn

B1 = Hor  
 Red = Upr

A-70 215518



PROJECT REMARKS

cellular bent monopole

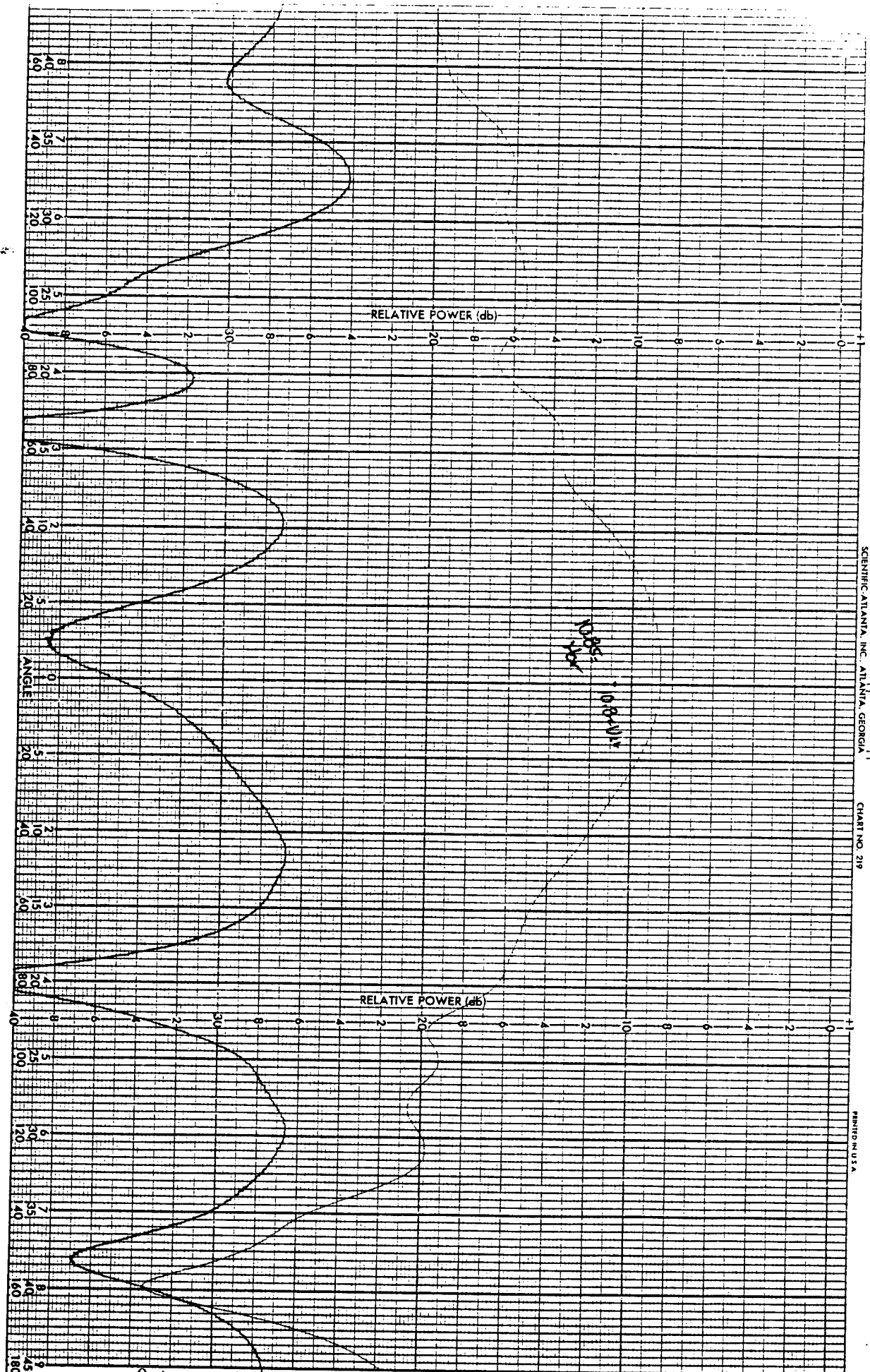
360 MHz

ENGR AZ

B1 = Hm

DATE 10-28-92

A=10 215520



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PROJECT REMARKS

Cellular Bent Monopole  
390 MHz

ENGR

AZ

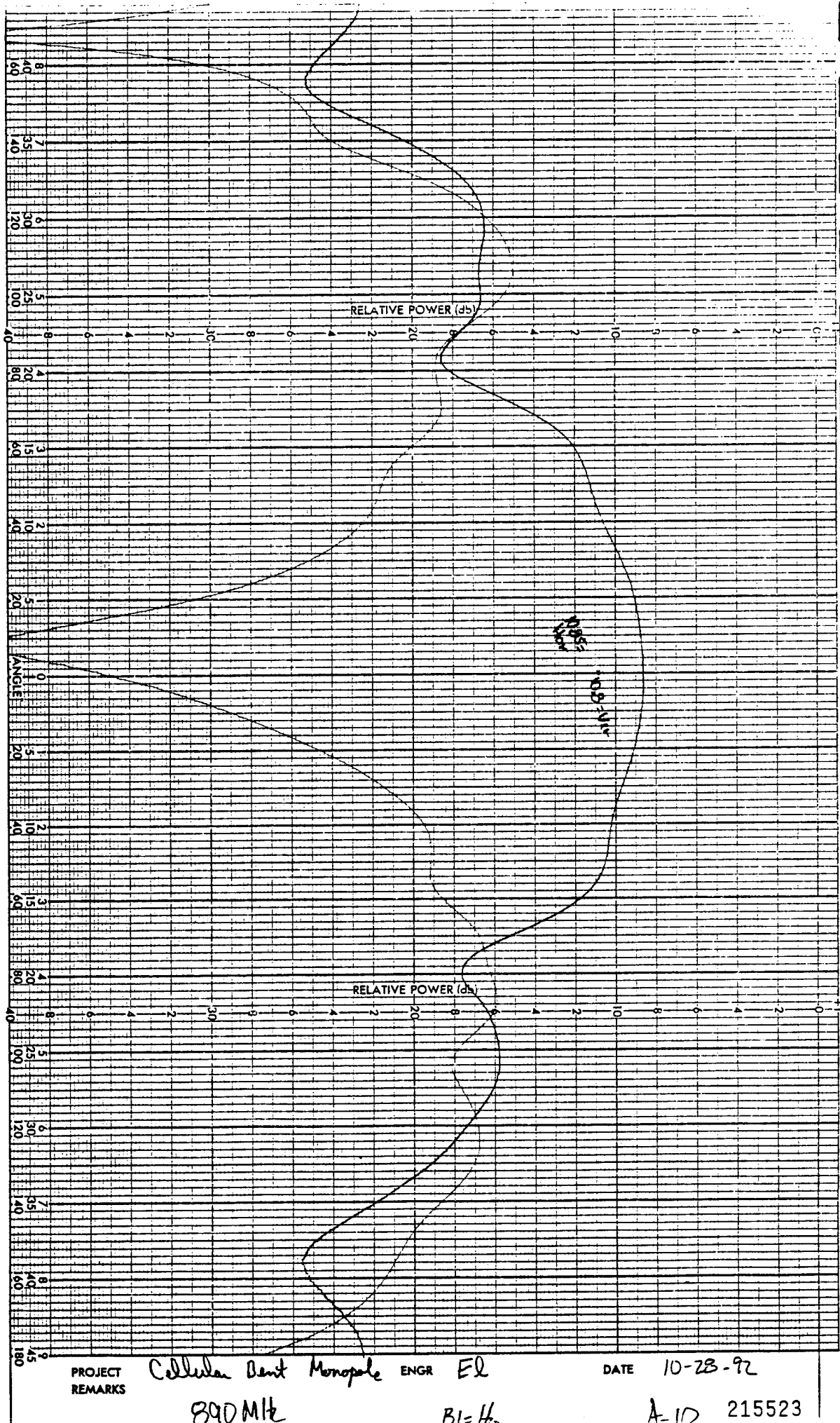
RI=LL

DATE

10-28-92

1.10

215522



PROJECT  
REMARKS

Cellular Base Monopole ENGR EL

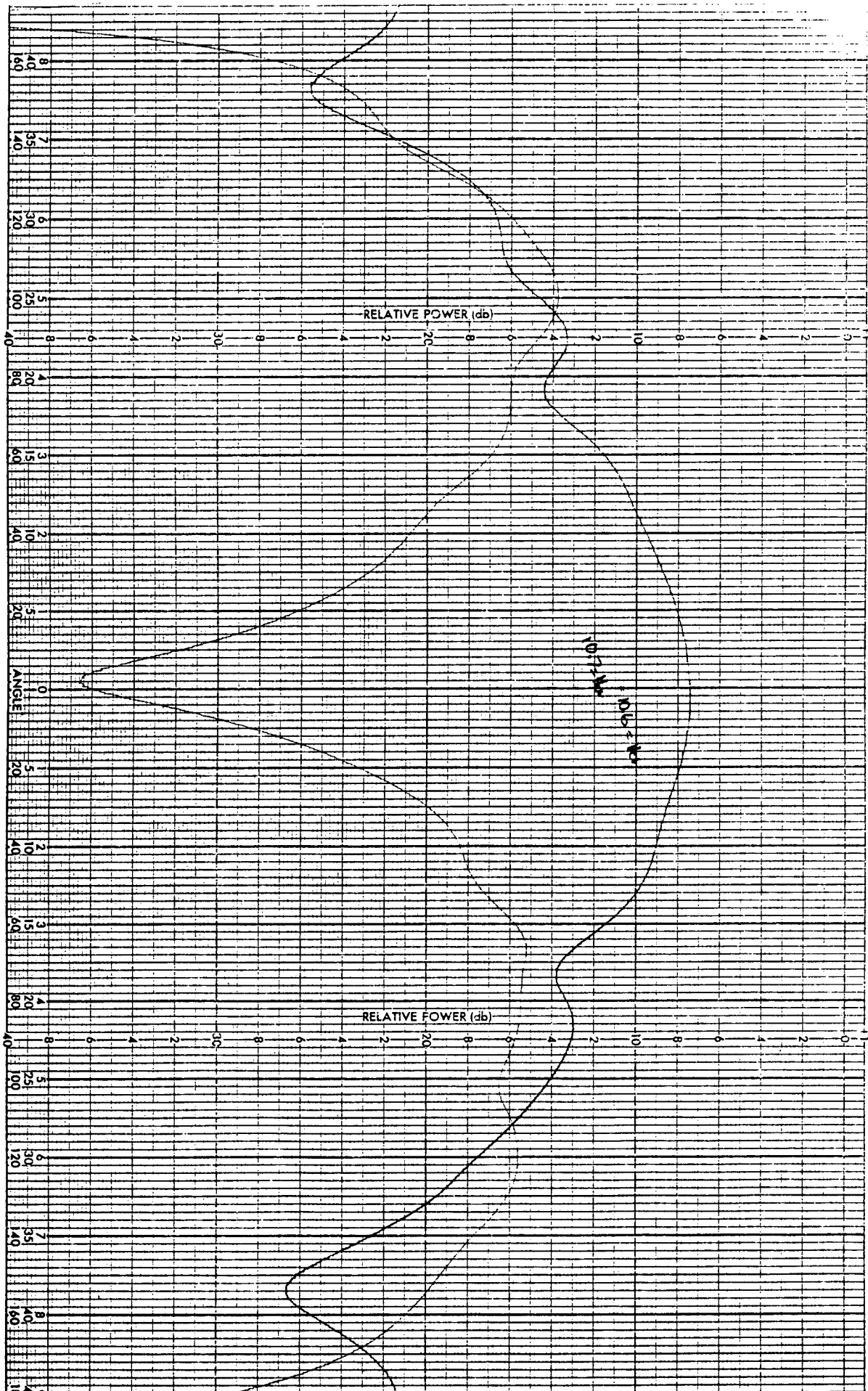
890 MHz

BI-H.

DATE 10-28-92

A-10 215523





SCIENTIFIC ATLANTA, INC. ATLANTA, GEORGIA

CHART NO. 219

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PROJECT  
REMARKS

Cellular Bent Manople

ENGR

EL

DATE

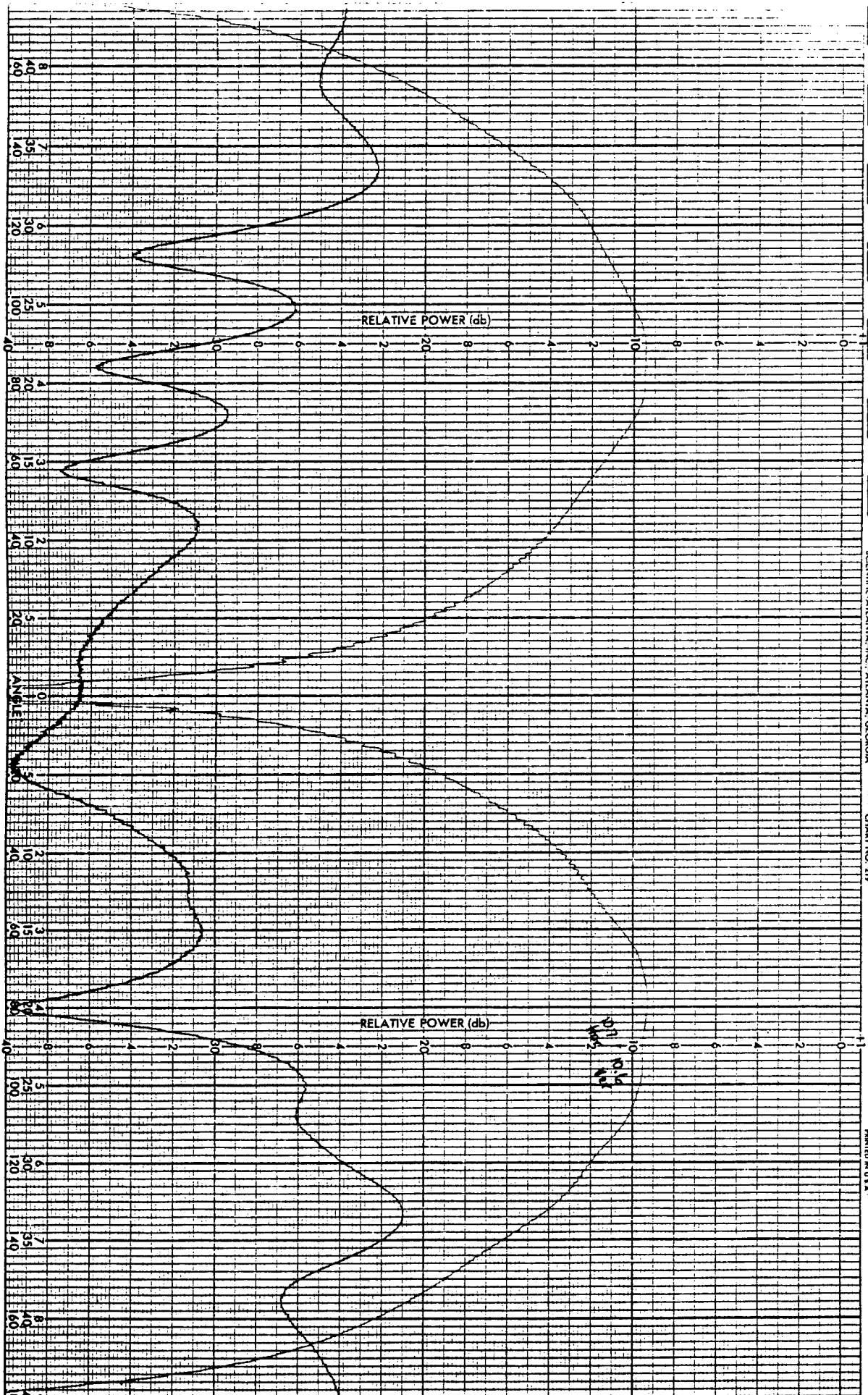
10-28-91

860 MHz

BI-HH

A=10 215524





PROJECT *Cellular Bow Tie*  
REMARKS

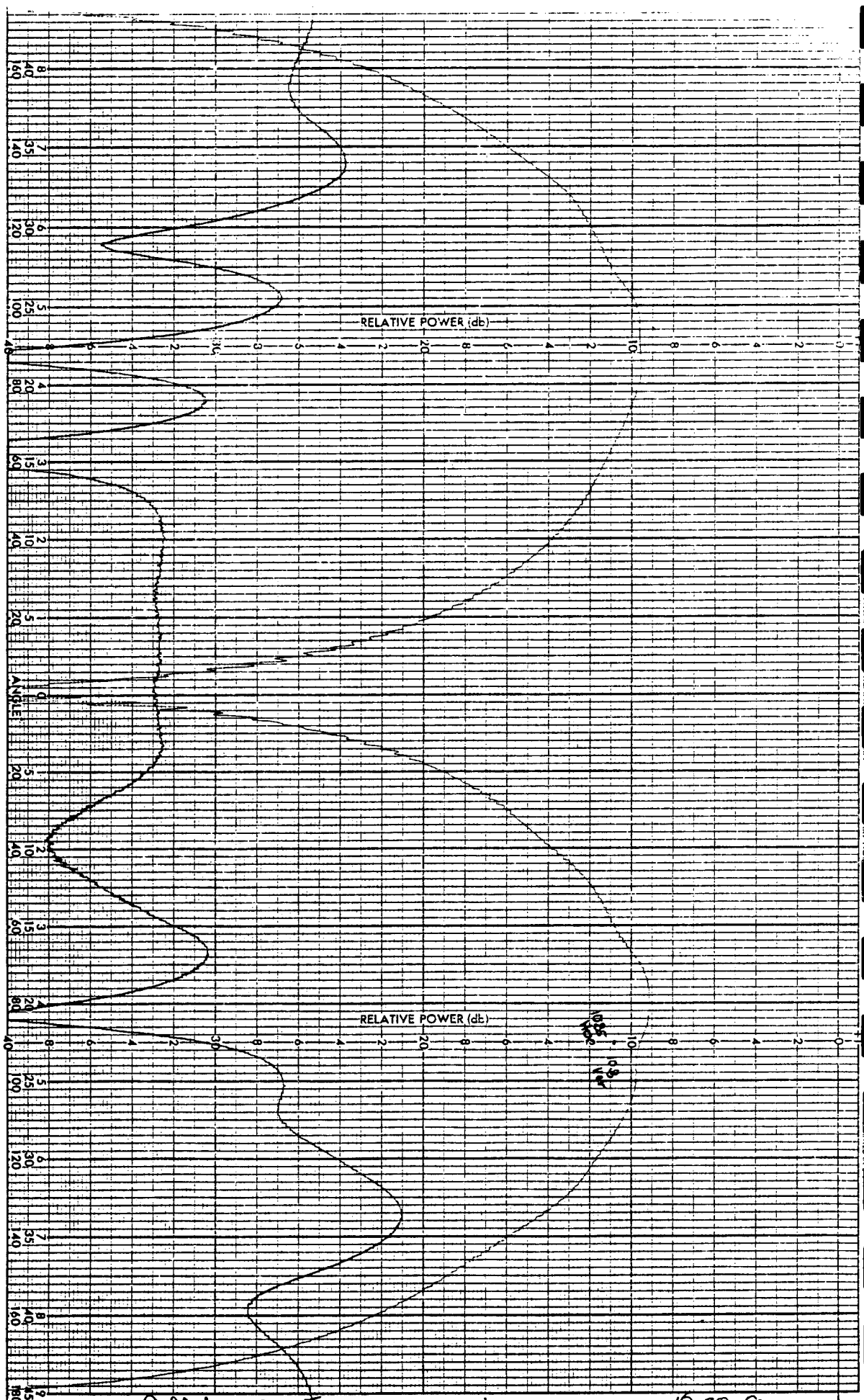
*860 MHz*

ENGR *A2*

*B1-Hr*

DATE *10-28-92*

*A-10* 215525



PROJECT  
REMARKS

Cellular Bow Tie  
890 MHz

ENGR

AZ

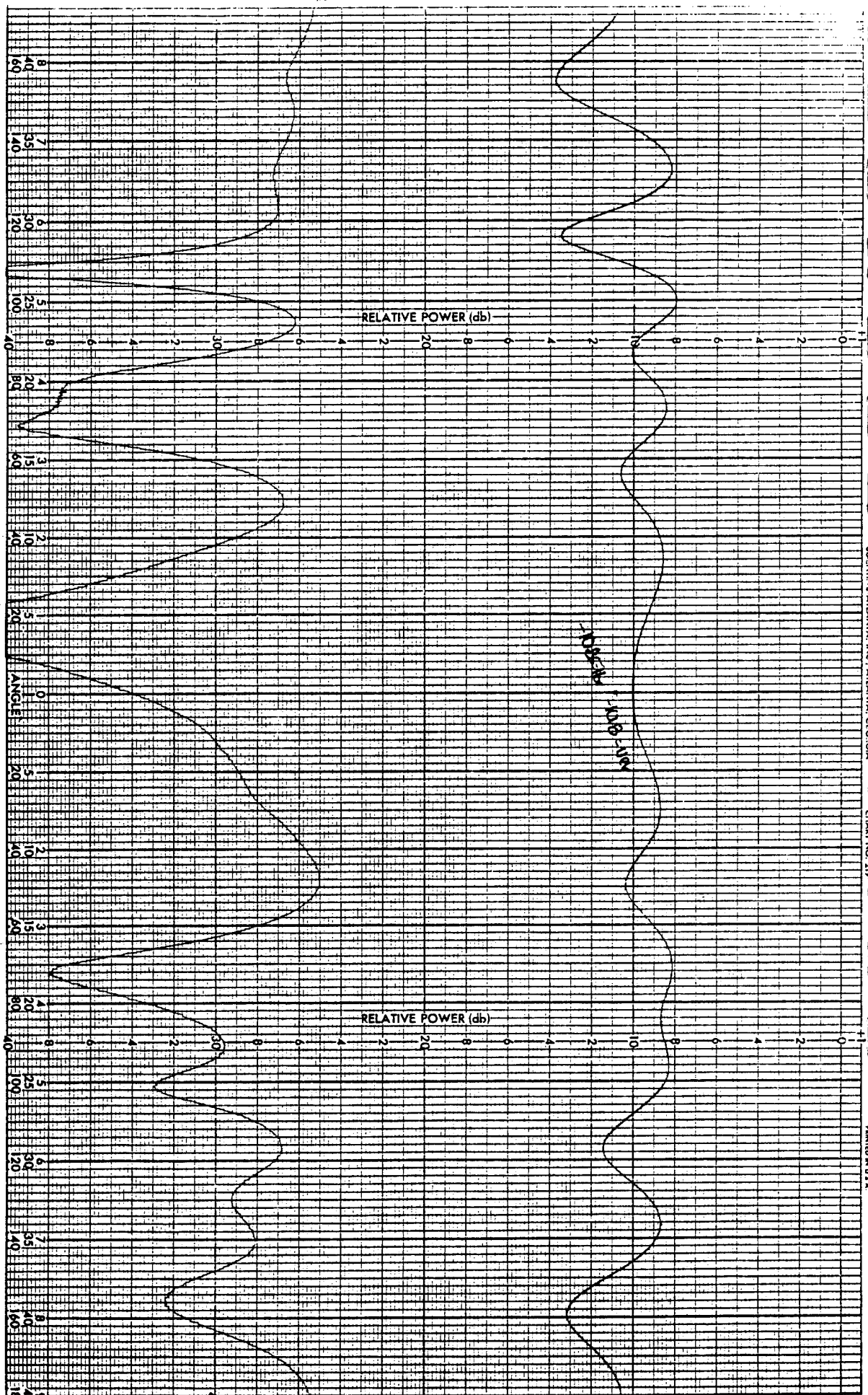
BI-H

DATE

10-28-92

A-10

215526



PROJECT  
REMARKS

Cellular Bow Tie

ENGR

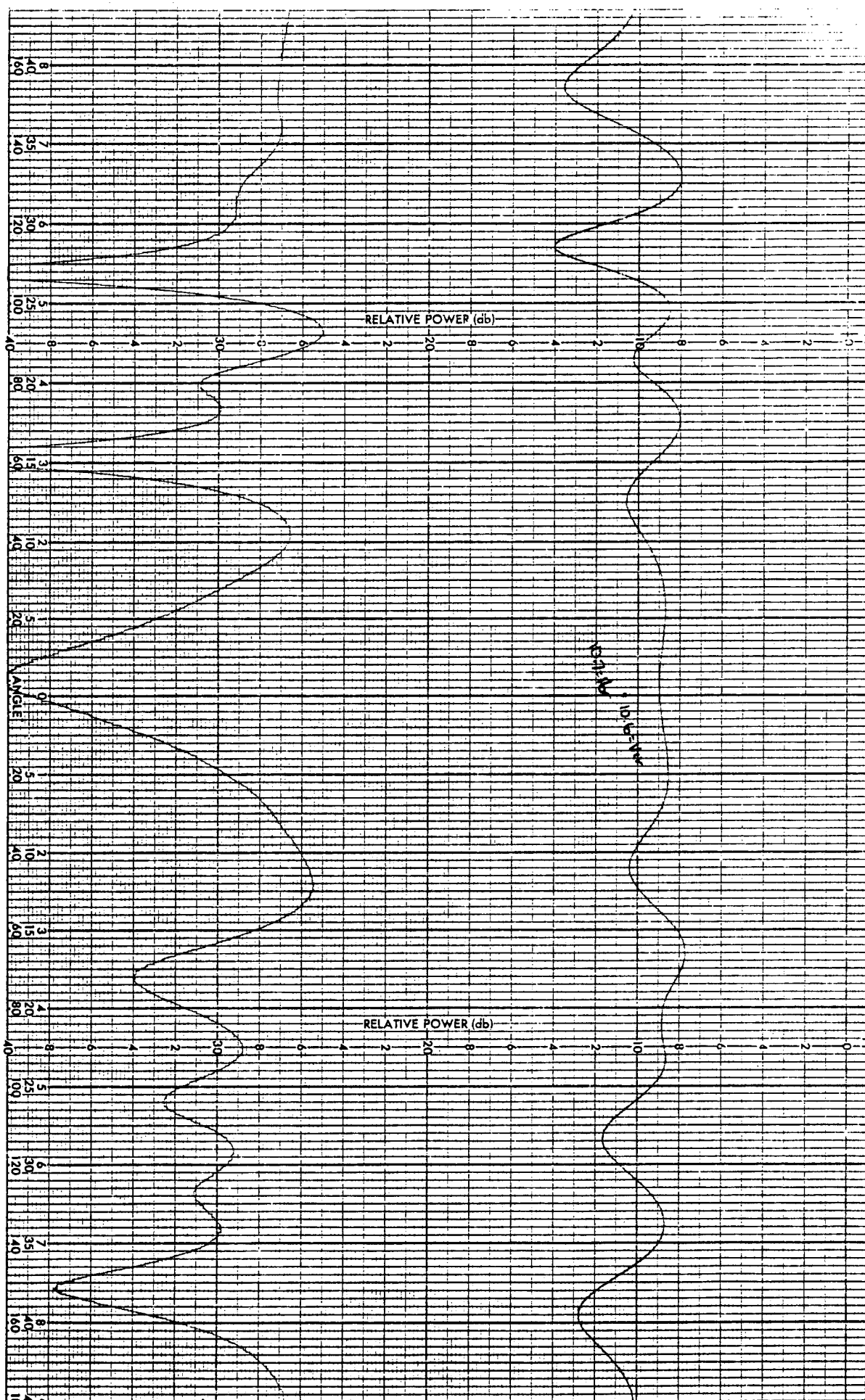
EL

DATE 10-28-92

890MHz

B1-Ha

A=10 215527



PROJECT  
REMARKS

Cellular Bow Tie

ENGR

EL

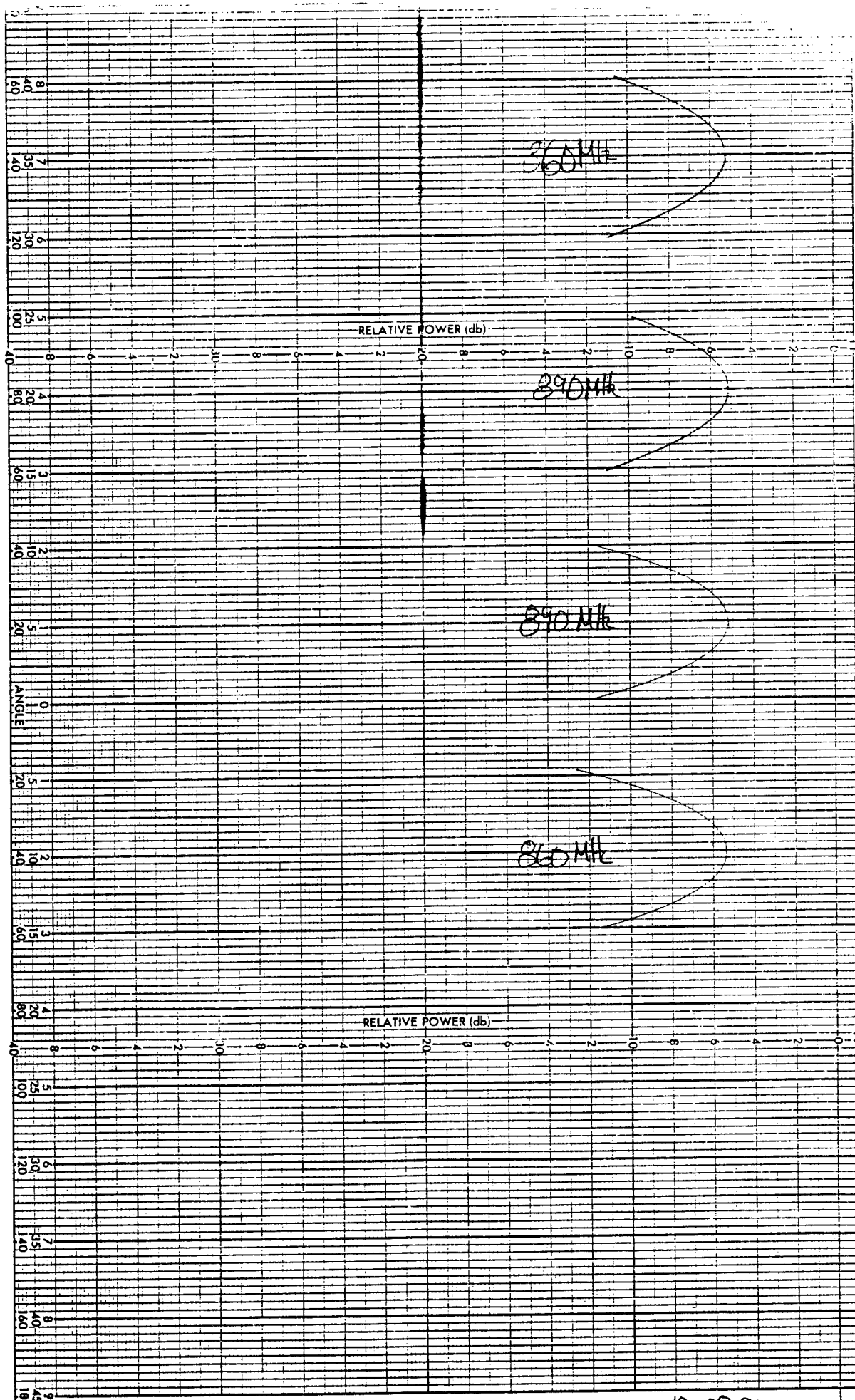
DATE

10-28-97

860 MHz

BI=Hon

A=10 215528



PROJECT  
REMARKS

ENGR

DATE 10-28-92

nl=4

215520



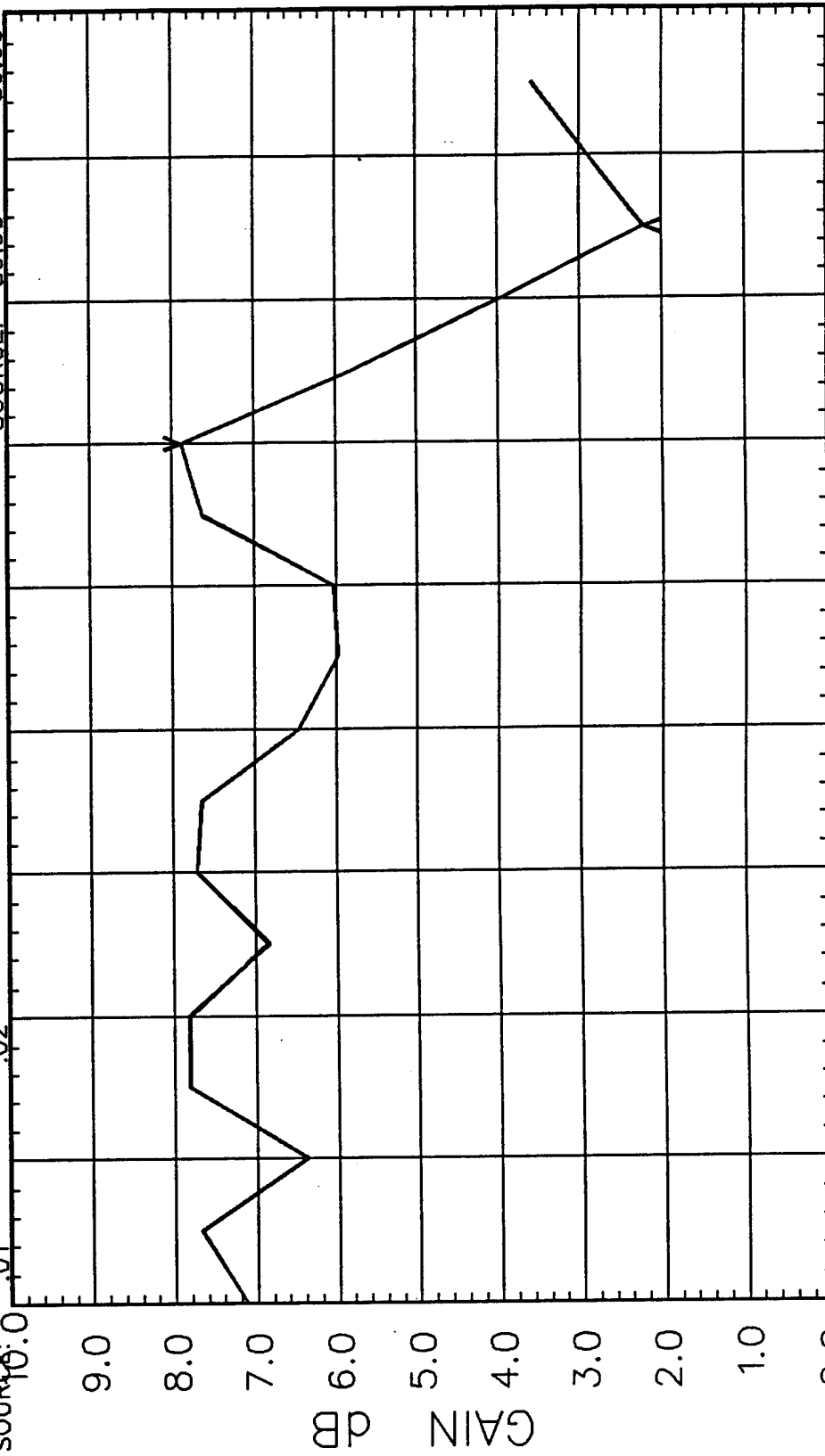
## **Appendix V**

### **Antenna Below Variable Aperture**

CAL FILE 1 DATA FILE 1 6" ABOVE 4FT GP  
NAME: TGNTSG1 6IN4FT1  
THETA: -.01  
PHI: .02  
SLIDE: -69.35 96.94  
SOURCE: .01 .02

# TAGGANT

CAL FILE 2 DATA FILE 2  
NAME: TGNTSG3 6IN4FT2  
THETA: -.02  
PHI: 89.97 .02  
SLIDE: -69.35 96.94  
SOURCE: 89.99 89.99



MAX 7.89 AT 370  
MIN 2.21 AT 400

FREQUENCY MHZ

OUTPUT FILE: TAGGANT

SGH IS AEL 250-500  
BALL AEROSPACE





6" ABOVE 4FT GP  
18 NOV 92

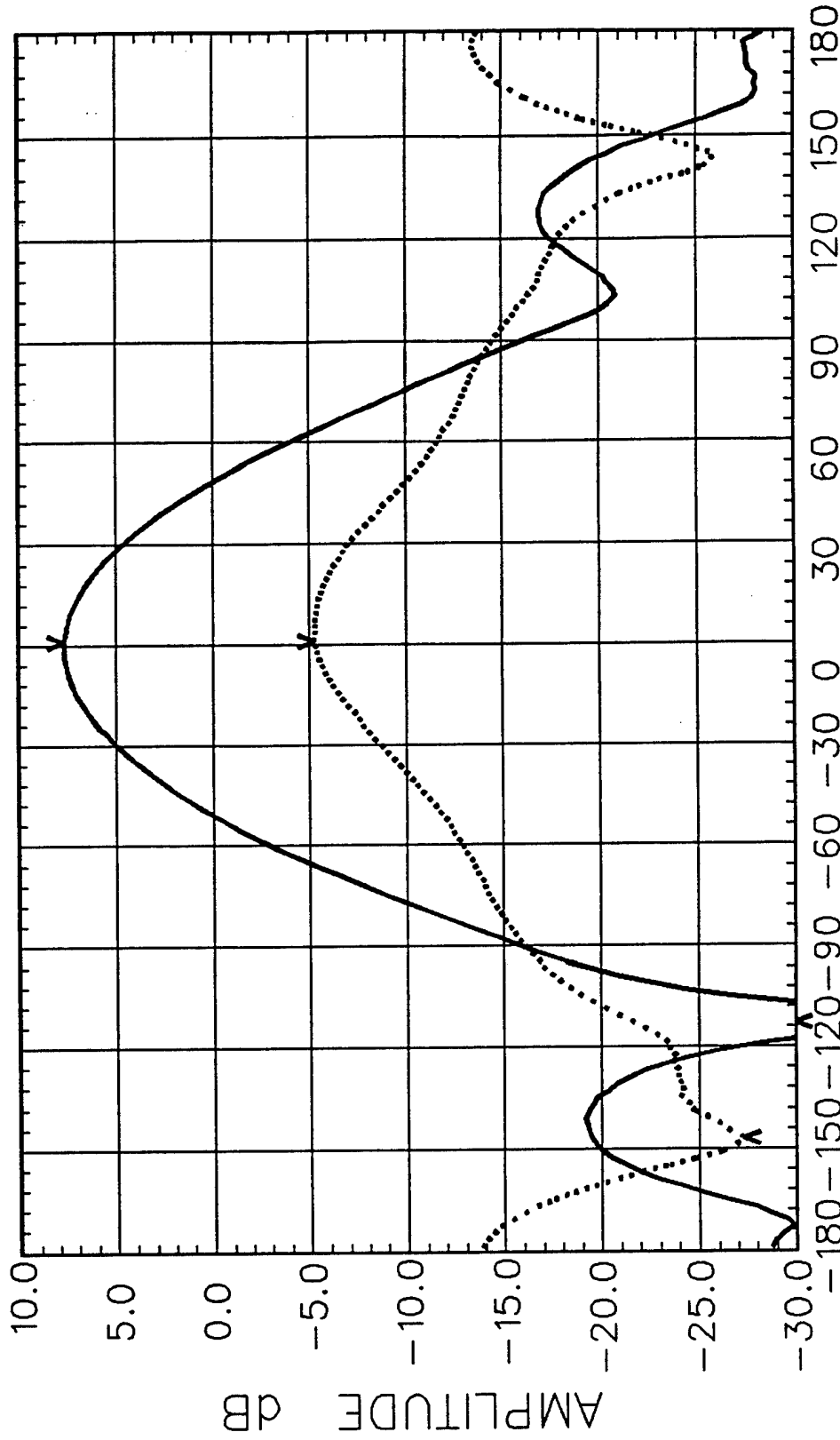
# TAGGANT

BALL AEROSPACE

CP6561 HAS 15dB IF ATTEN  
CP6561 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

260MHz RHCP GAIN PHI=  
260MHz LHCP GAIN PHI=



THETA ANGLE

MAX: 7.70dB at 1deg MIN: -38.64dB at -113deg  
MAX: -5.23dB at 1deg MIN: -27.33dB at -147deg

6" ABOVE 4FT GP  
18 NOV 92

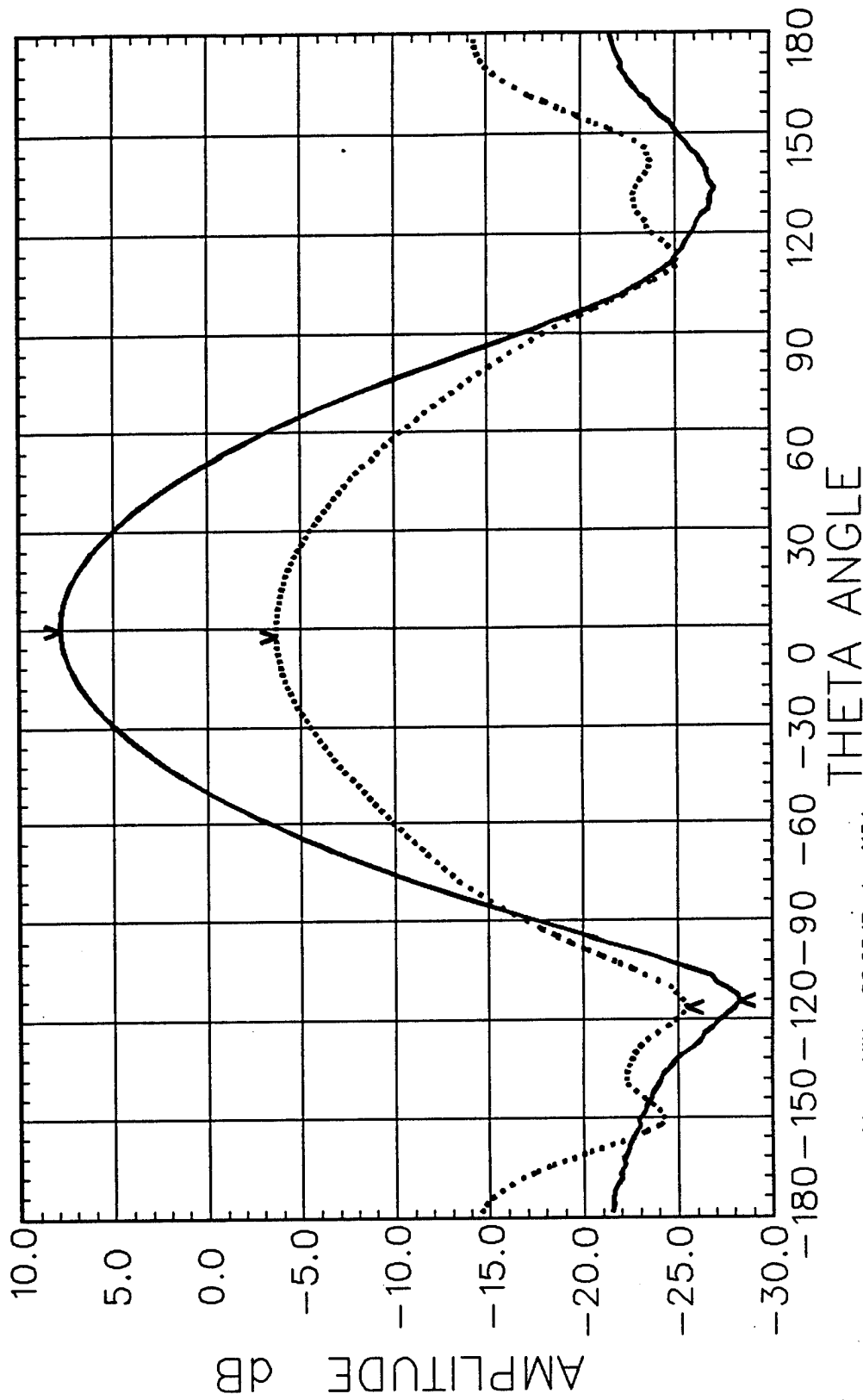
# TAGGANT

BALL AEROSPACE

CP6562 HAS 15dB IF ATTEN  
CP6562 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

290MHz RHCP GAIN PHI=  
290MHz LHCP GAIN PHI=



MAX: 7.81dB at -1deg MIN: -28.28dB at -115deg  
MAX: 3.68dB at -3deg MIN: -25.53dB at -117deg

6" ABOVE 4FT GP  
18 NOV 92

# TAGGANT

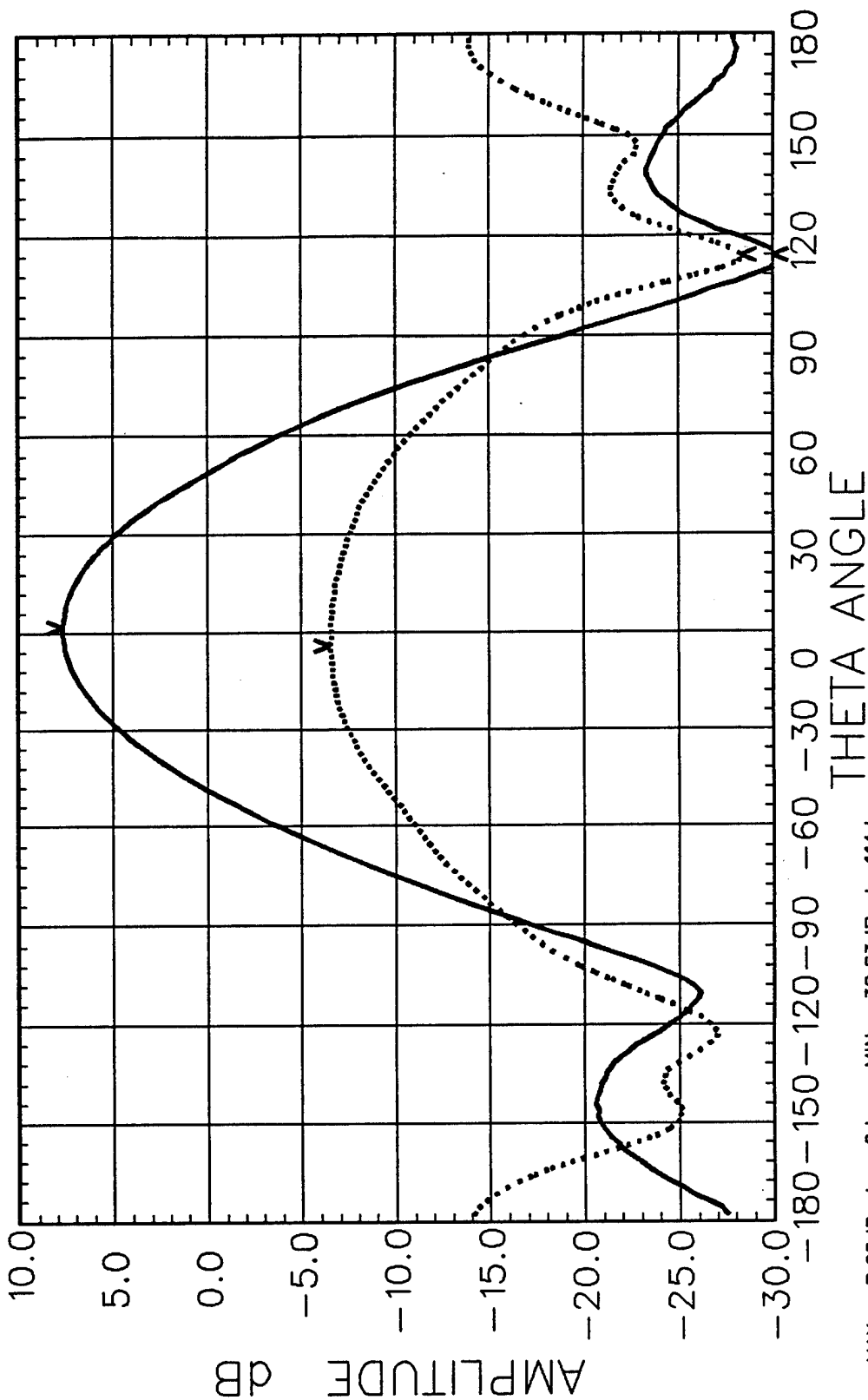
BALL AEROSPACE

CP6563 HAS 15dB IF ATTEN  
CP6563 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

320MHz RHCP GAIN PHI=  
320MHz LHCP GAIN PHI=

is  
is



MAX: 7.66dB at 2deg MIN: -30.63dB at 114deg  
MAX: -6.52dB at -4deg MIN: -28.34dB at 114deg

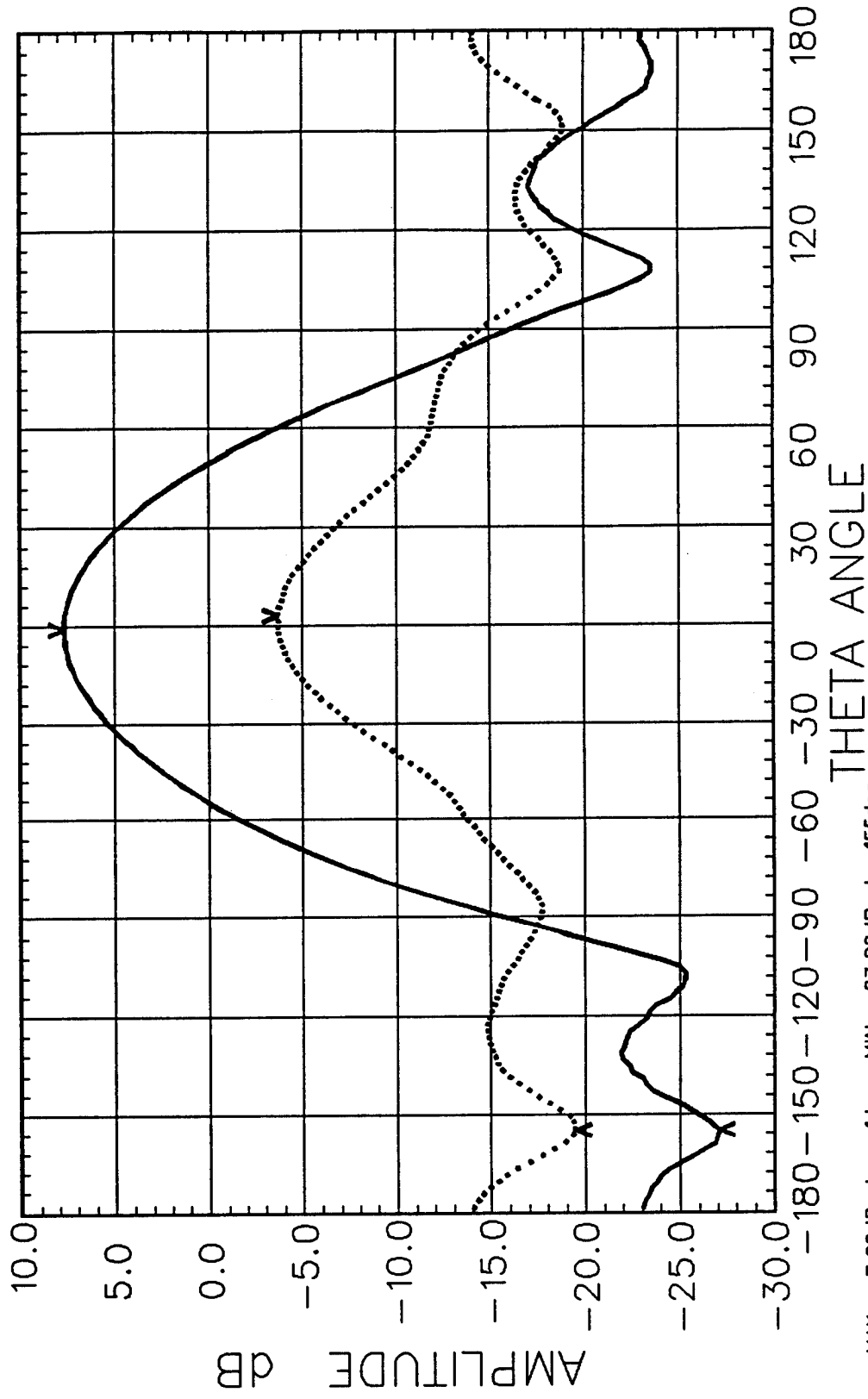
6" ABOVE 4FT GP  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6581 HAS 15dB IF ATTEN  
CP6581 HAS 15dB IF ATTEN

— is 260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 7.69dB at -1deg MIN: -27.09dB at -155deg  
..... MAX: -3.69dB at 3deg MIN: -19.50dB at -155deg

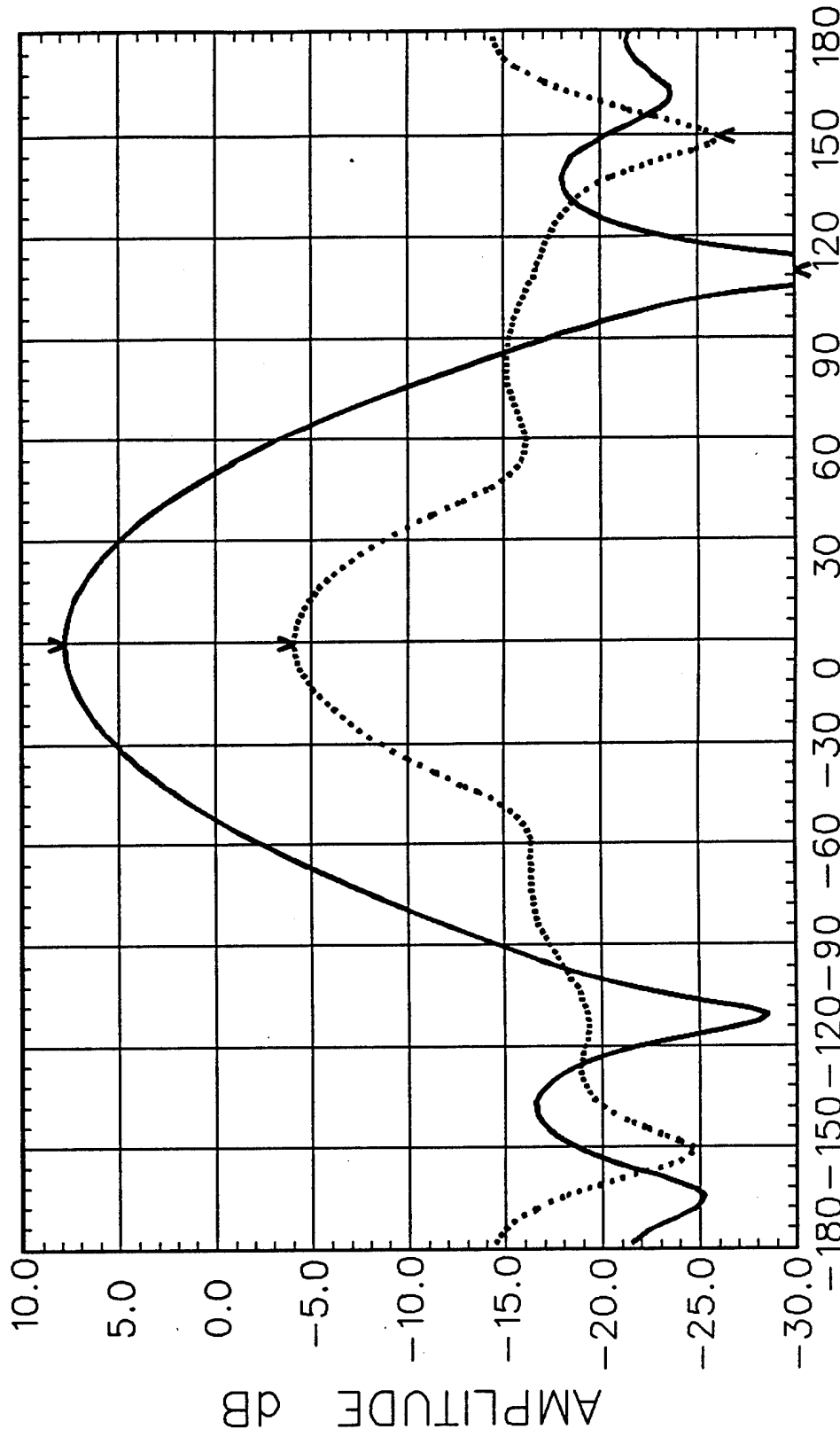
6" ABOVE 4FT GP  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6582 HAS 15dB IF ATTEN  
CP6582 HAS 15dB IF ATTEN

290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



THETA ANGLE

— MAX: 7.77dB at -1deg MIN: -49.92dB at 109deg  
..... MAX: -4.09dB at -1deg MIN: -26.13dB at 149deg

2) RPL07:19 MAY 92 CPXFM:28 OCT 91  
1) RPL07:19 MAY 92 CPXFM:28 OCT 91

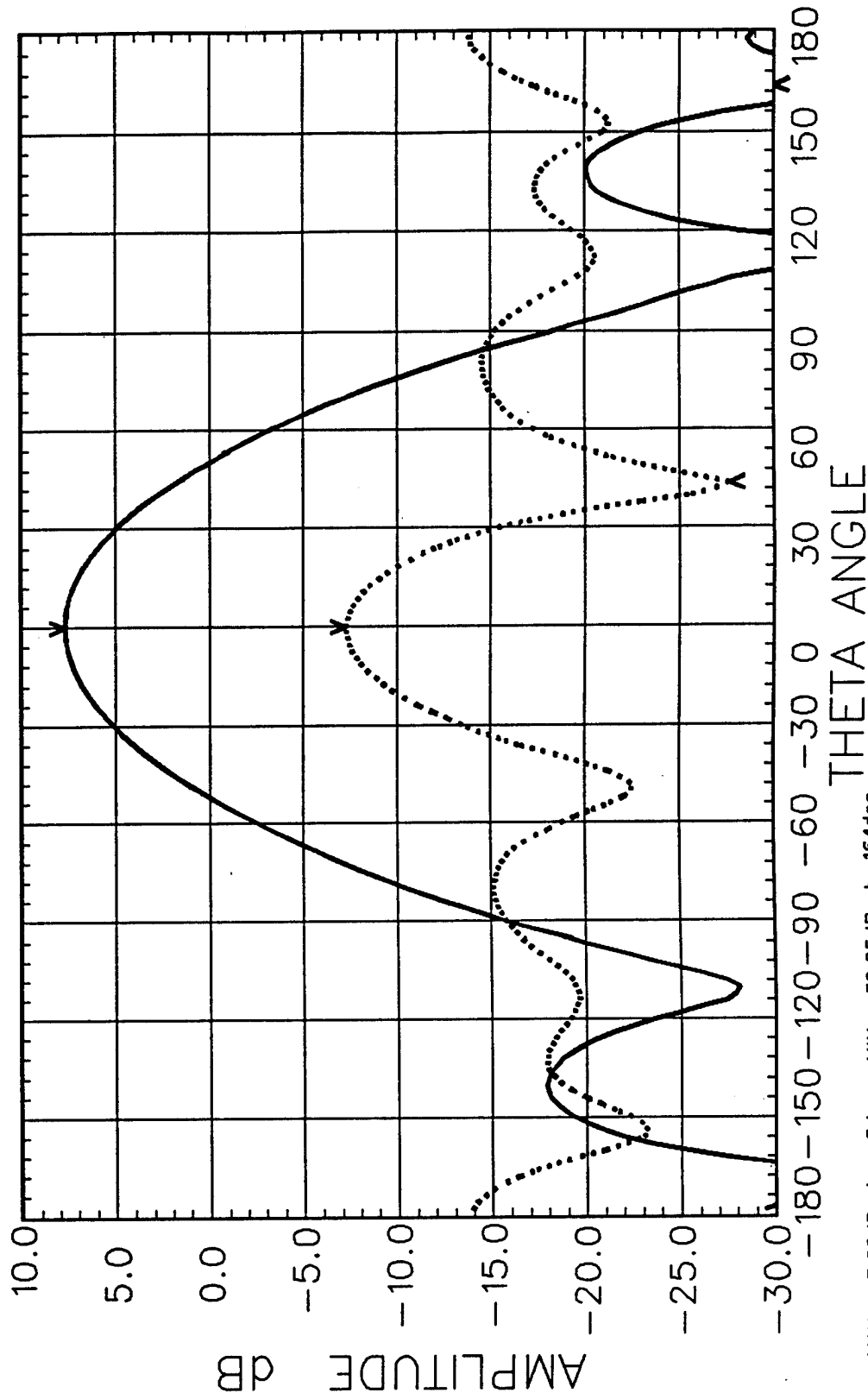
6" ABOVE 4FT GP  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6583 HAS 15dB IF ATTEN  
CP6583 HAS 15dB IF ATTEN

— is 320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 7.69dB at 0deg MIN: -59.95dB at 164deg  
..... MAX: -7.27dB at 0deg MIN: -27.65dB at 44deg

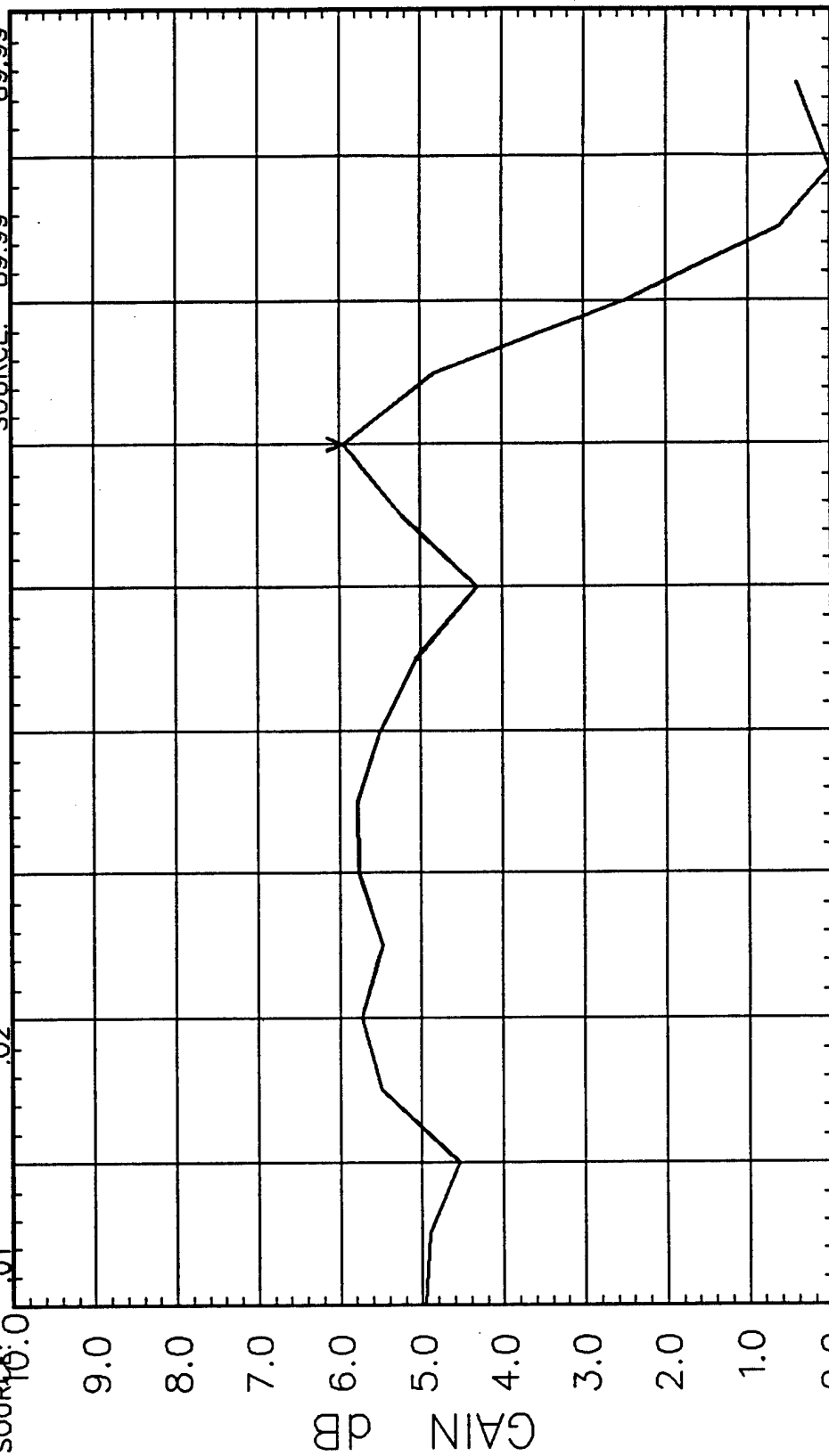
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10) REPT:19 MAY 92  
11) REPT:19 MAY 92  
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96) REPT:19 MAY 92  
97) REPT:19 MAY 92  
98) REPT:19 MAY 92  
99) REPT:19 MAY 92  
100) REPT:19 MAY 92

CAL FILE 1 DATA FILE 1 1/8 BELOW GP, 1" BORDER

NAME: TGNTSG1  
THETA: -.01  
PHI: .00  
SLIDE: 96.74  
SOURCE: .02

CAL FILE 2 DATA FILE 2  
NAME: TGNTSG3  
THETA: -.02  
PHI: 89.97  
SLIDE: -69.35  
SOURCE: 89.99

# TAGGANT



MAX 5.95 AT 370  
MIN -.14 AT 410

FREQUENCY MHZ

OUTPUT FILE: TAGGANT

SGH IS AEL 250-500  
BALL AEROSPACE

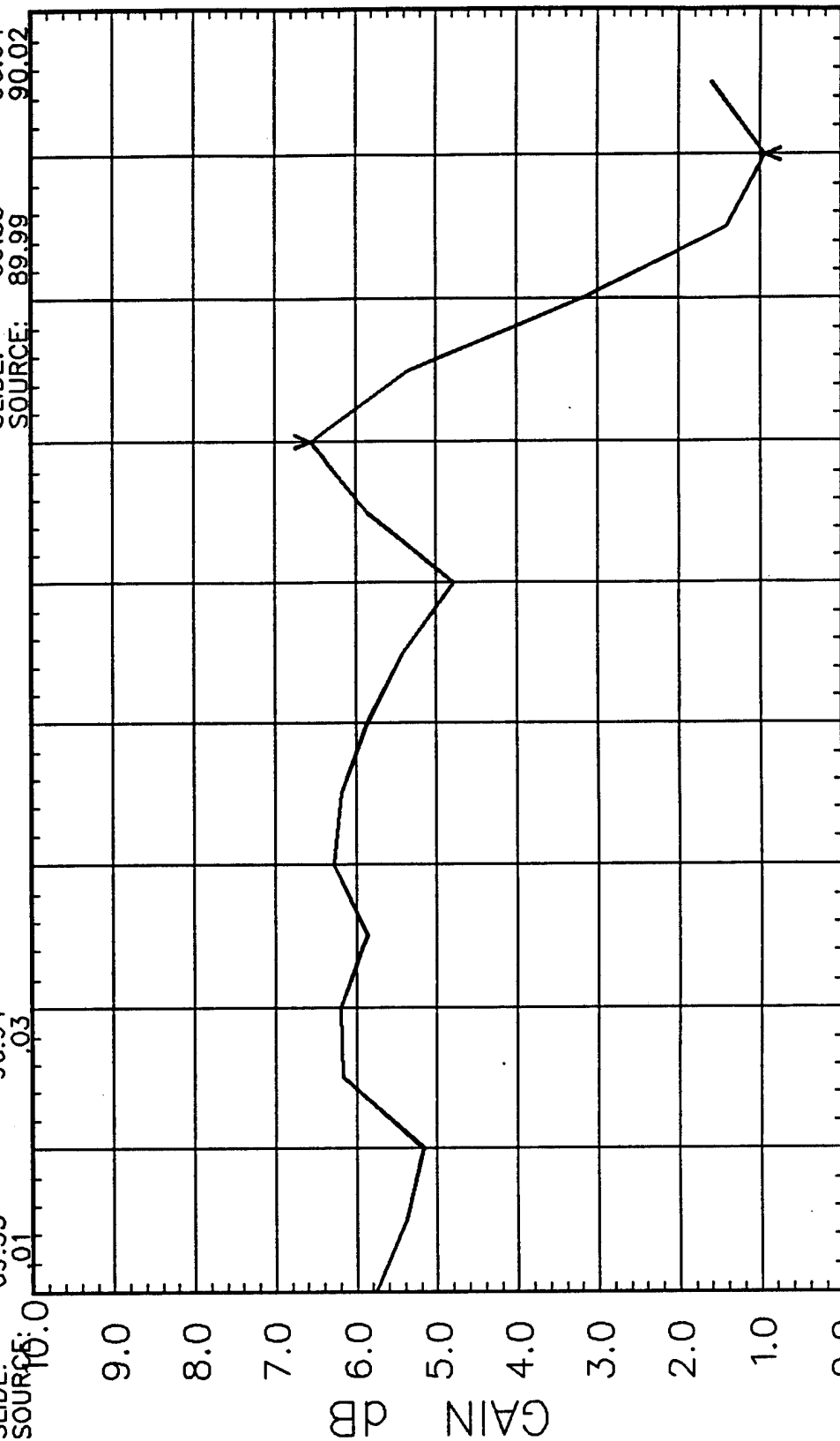
[illegible]



CAL FILE 1 DATA FILE 1 1/8"BELOW GP,2"BORDER  
TGNTSG1 1D82IN1 18 NOV 92

CAL FILE 2 DATA FILE 2  
TGNTSG3 1D82IN2  
NAME: THETA: .02  
PHI: 89.97  
SLIDE: -69.35  
SOURCE: 96.94

# TAGGANT



MAX 6.55 AT 370  
MIN .94 AT 410

SGH IS AEL 250-500  
BALL AEROSPACE

OUTPUT FILE: TAGGANT

```

*****
*
*               TAGGANT
* 1/8"BELOW GP,2"BORDER      18 NOV 92
* CAL FILE #1 : TGNTSG1
*   THETA ANGLE:  -.02      PHI ANGLE:      .00
*   SLIDE ANGLE: -69.35    SOURCE ANGLE:    .01
*
* CAL FILE #2 : TGNTSG3
*   THETA ANGLE:  -.02      PHI ANGLE:      89.97
*   SLIDE ANGLE: -69.35    SOURCE ANGLE:    89.99
*
* DATA FILE #1 :1D82IN1
*   THETA ANGLE:   .02      PHI ANGLE:      -.03
*   SLIDE ANGLE:  96.94    SOURCE ANGLE:    .03
*
* DATA FILE #2 :1D82IN2
*   THETA ANGLE:   .02      PHI ANGLE:      -.03
*   SLIDE ANGLE:  96.94    SOURCE ANGLE:    90.02
*
* OUTPUT FILE:   TAGGANT
* GAIN STANDARD:  AEL 250-500
*
*****
*
*   FREQ      RHCP      LHCP      AXIAL      TILT      SGH
*   MHZ      GAIN      GAIN      RATIO      ANGLE      GAIN
*   250.     5.75     -3.99     5.88     88.21     11.30
*   260.     5.38     -.95     9.14     35.68     11.57
*   270.     5.17     -3.80     6.47    -42.60     11.84
*   280.     6.17     -6.55     4.09     21.00     12.11
*   290.     6.19     -6.32     4.19     81.02     12.38
*   300.     5.86     -6.67     4.18    -29.00     12.65
*   310.     6.27     -8.05     3.38     11.27     12.89
*   320.     6.18     -7.08     3.84     66.93     13.13
*   330.     5.86     -9.08     3.14    -66.80     13.37
*   340.     5.41    -12.51     2.22    -77.99     13.61
*   350.     4.78     -9.13     3.55     28.70     13.85
*   360.     5.86     -9.58     2.96     53.53     14.02
*   370.     6.55    -11.83     2.10     60.68     14.19
*   380.     5.35    -20.28     .91     -16.65     14.36
*   390.     3.20    -17.89     1.54     -5.37     14.53
*   400.     1.40    -13.49     3.16      9.35     14.70
*   410.      .94    -20.56     1.47     36.39     14.91
*   420.     1.59    -17.39     1.96     40.98     15.12
*
*****

```

# 1/8"BELOW GP,3"BORDER

CAL FILE 1

DATA FILE 1

1D83IN1

NAME: TGNTSG1

THETA: -.02

PHI: .03

SLIDE: -69.35

SOURCE: .03

DATA FILE 2

1D83IN2

NAME: TGNTSG3

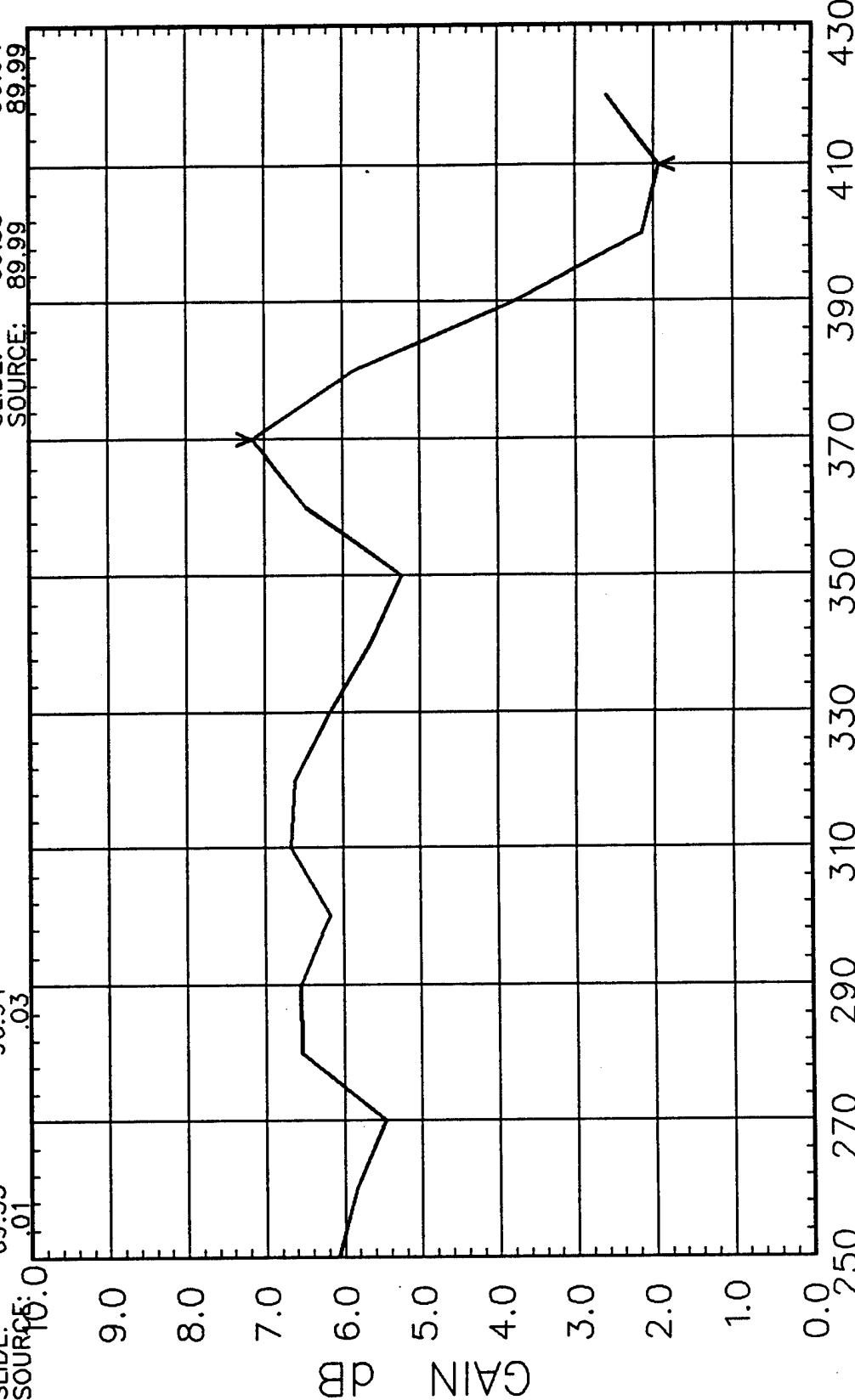
THETA: -.02

PHI: 89.97

SLIDE: -69.35

SOURCE: 89.99

TAGGANT



MAX 7.15 AT 370  
MIN 1.93 AT 410

FREQUENCY MHZ

OUTPUT FILE: TAGGANT

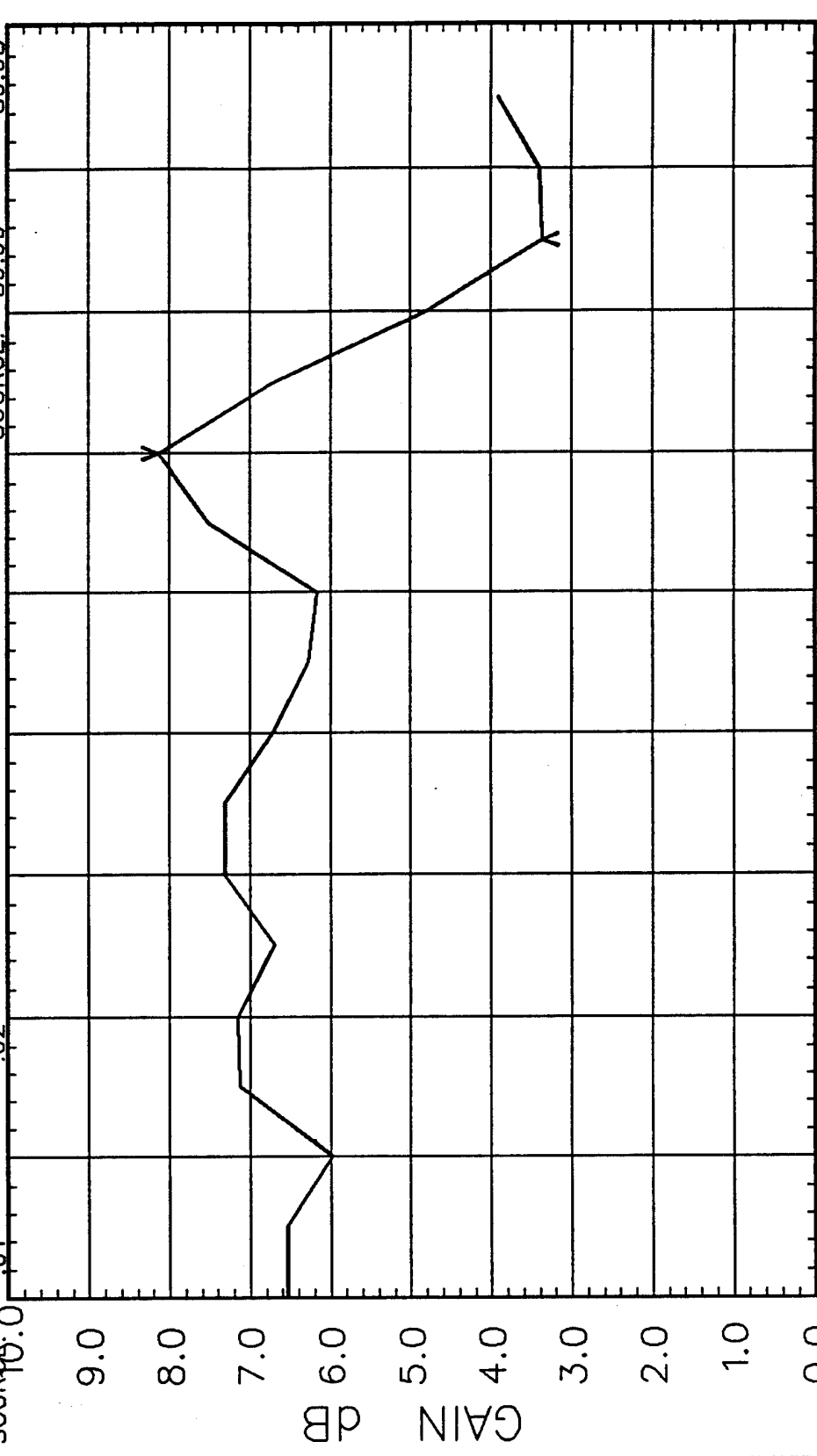
SGH IS AEL 250-500  
BALL AEROSPACE

```
*****
*                                     *
*               TAGGANT              *
*   1/8"BELOW GP,3"BORDER    18 NOV 92      *
*   CAL FILE #1 : TGNTSG1          *
*       THETA ANGLE:   -.02         PHI ANGLE:   .00      *
*       SLIDE ANGLE: -69.35        SOURCE ANGLE:   .01      *
*                                     *
*   CAL FILE #2 : TGNTSG3          *
*       THETA ANGLE:   -.02         PHI ANGLE:   89.97     *
*       SLIDE ANGLE: -69.35        SOURCE ANGLE:  89.99     *
*                                     *
*   DATA FILE #1 :1D83IN1         *
*       THETA ANGLE:   -.02         PHI ANGLE:   .03      *
*       SLIDE ANGLE:   96.94        SOURCE ANGLE:   .03      *
*                                     *
*   DATA FILE #2 :1D83IN2         *
*       THETA ANGLE:   -.02         PHI ANGLE:   .03      *
*       SLIDE ANGLE:   96.94        SOURCE ANGLE:  89.99     *
*                                     *
*   OUTPUT FILE:   TAGGANT          *
*   GAIN STANDARD: AEL 250-500      *
*                                     *
*****
*                                     *
*   FREQ      RHCP      LHCP      AXIAL      TILT      SGH      *
*   MHZ      GAIN      GAIN      RATIO      ANGLE      GAIN      *
*   250.      6.08      -6.40      4.21      -89.21      11.30     *
*   260.      5.84      -1.83      7.64      34.82      11.57     *
*   270.      5.47      -3.83      6.21      -38.37      11.84     *
*   280.      6.54      -8.14      3.24      20.20      12.11     *
*   290.      6.55      -7.47      3.51      85.52      12.38     *
*   300.      6.17      -6.23      4.25      -25.51      12.65     *
*   310.      6.67      -8.76      2.97      11.41      12.89     *
*   320.      6.61      -8.25      3.18      70.02      13.13     *
*   330.      6.17      -8.91      3.09      -59.36      13.37     *
*   340.      5.64      -12.94      2.05      -69.77      13.61     *
*   350.      5.24      -9.74      3.13      29.74      13.85     *
*   360.      6.47      -11.14      2.30      60.28      14.02     *
*   370.      7.15      -14.13      1.50      69.53      14.19     *
*   380.      5.85      -15.44      1.50      -22.92      14.36     *
*   390.      3.78      -16.15      1.76      -10.83      14.53     *
*   400.      2.14      -13.19      3.00      7.92      14.70     *
*   410.      1.93      -26.18      .68      46.26      14.91     *
*   420.      2.60      -19.99      1.29      52.46      15.12     *
*                                     *
*****
```

CAL FILE 1 DATA FILE 1 1/8"BELOW GP,5"BORDER  
 NAME: TGNTSG1 1D85IN1  
 THETA: -.02  
 PHI: -.04  
 SLIDE: -69.35 96.94  
 SOURCE: .01 .02

CAL FILE 2 DATA FILE 2  
 NAME: TGNTSG3 1D85IN2  
 THETA: -.02  
 PHI: 89.97  
 SLIDE: -69.35 96.94  
 SOURCE: 89.99 89.98

# TAGGANT



MAX 8.13 AT 370  
 MIN 3.36 AT 400

FREQUENCY MHZ

OUTPUT FILE: TAGGANT

SGH IS AEL 250-500  
 BALL AEROSPACE

```

*****
*
*               TAGGANT
* 1/8"BELOW GP,5"BORDER      18 NOV 92
* CAL FILE #1 : TGNTSG1
*   THETA ANGLE:  -.02      PHI ANGLE:      .00
*   SLIDE ANGLE: -69.35     SOURCE ANGLE:    .01
*
* CAL FILE #2 : TGNTSG3
*   THETA ANGLE:  -.02      PHI ANGLE:      89.97
*   SLIDE ANGLE: -69.35     SOURCE ANGLE:    89.99
*
* DATA FILE #1 :1D85IN1
*   THETA ANGLE:   .02      PHI ANGLE:      -.04
*   SLIDE ANGLE:  96.94     SOURCE ANGLE:    .02
*
* DATA FILE #2 :1D85IN2
*   THETA ANGLE:   .02      PHI ANGLE:      -.04
*   SLIDE ANGLE:  96.94     SOURCE ANGLE:    89.98
*
* OUTPUT FILE:  TAGGANT
* GAIN STANDARD: AEL 250-500
*
*****

```

```

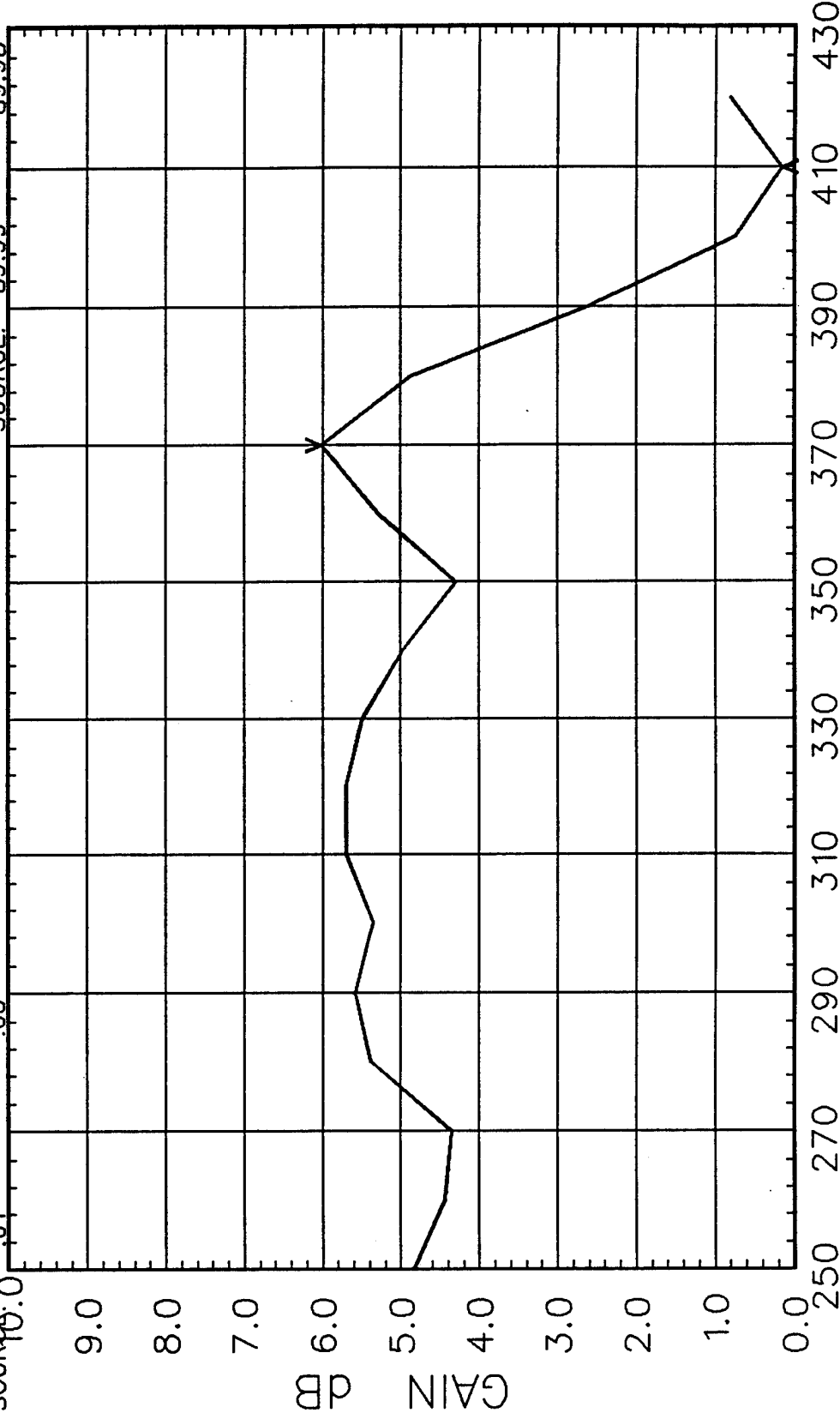
*****
*
*   FREQ      RHCP      LHCP      AXIAL      TILT      SGH
*   MHZ      GAIN      GAIN      RATIO      ANGLE      GAIN
*   250.      6.54      -8.59      3.07      -78.71      11.30
*   260.      6.54      -3.82      5.44      34.39      11.57
*   270.      5.98      -3.27      6.25      -35.76      11.84
*   280.      7.13      -12.31     1.86      18.20      12.11
*   290.      7.15      -8.14      3.02      -84.60      12.38
*   300.      6.70      -5.09      4.58      -24.34      12.65
*   310.      7.32      -11.01     2.12      7.61      12.89
*   320.      7.31      -9.00      2.68      80.37      13.13
*   330.      6.72      -6.80      3.72      -52.91      13.37
*   340.      6.27      -10.14     2.65      -62.27      13.61
*   350.      6.17      -11.68     2.24      32.06      13.85
*   360.      7.51      -11.19     2.03      78.16      14.02
*   370.      8.13      -12.87     1.55      -86.65      14.19
*   380.      6.73      -10.70     2.35      -31.45      14.36
*   390.      4.81      -13.78     2.05      -21.67      14.53
*   400.      3.36      -13.25     2.59      3.15      14.70
*   410.      3.39      -21.41     1.00      -76.49      14.91
*   420.      3.91      -17.91     1.41      88.47      15.12
*
*****

```

CAL FILE 1 DATA FILE 1 1/2"BELOW GP,1"BORDER  
NAME: TGNTSG1 1D21IN1 18 NOV 92  
THETA: -.03  
PHI: -.04  
SLIDE: -69.35 96.98  
SOURCE: .01 .03

CAL FILE 2 DATA FILE 2  
NAME: TGNTSG3 1D21IN2  
THETA: -.02  
PHI: 89.97  
SLIDE: -69.35 96.94  
SOURCE: 89.99 89.98

# TAGGANT



MAX 6.01 AT 370  
MIN .15 AT 410

FREQUENCY MHZ

OUTPUT FILE: TAGGANT

SGH IS AEL 250-500  
BALL AEROSPACE

```

*****
*
*
*           TAGGANT
* 1/2"BELOW GP,1"BORDER      18 NOV 92
* CAL FILE #1 : TGNTSG1
*      THETA ANGLE:  -.02      PHI ANGLE:      .00
*      SLIDE ANGLE: -69.35     SOURCE ANGLE:   .01
*
* CAL FILE #2 : TGNTSG3
*      THETA ANGLE:  -.02      PHI ANGLE:      89.97
*      SLIDE ANGLE: -69.35     SOURCE ANGLE:   89.99
*
* DATA FILE #1 :1D21IN1
*      THETA ANGLE:   .03      PHI ANGLE:      -.04
*      SLIDE ANGLE:  96.98     SOURCE ANGLE:   .03
*
* DATA FILE #2 :1D21IN2
*      THETA ANGLE:   .03      PHI ANGLE:      -.04
*      SLIDE ANGLE:  96.94     SOURCE ANGLE:   89.98
*
* OUTPUT FILE:   TAGGANT
* GAIN STANDARD: AEL 250-500
*
*****
*
*
*  FREQ      RHCP      LHCP      AXIAL      TILT      SGH
*  MHZ      GAIN      GAIN      RATIO      ANGLE      GAIN
*  250.     4.83     -1.70     8.89     -83.11     11.30
*  260.     4.44     -.39     11.34     41.64     11.57
*  270.     4.35     -3.45     7.51     -45.71     11.84
*  280.     5.39     -4.56     5.72     24.91     12.11
*  290.     5.59     -4.60     5.56     84.60     12.38
*  300.     5.35     -6.83     4.37     -32.77     12.65
*  310.     5.70     -6.46     4.38     15.57     12.89
*  320.     5.70     -5.93     4.66     68.76     13.13
*  330.     5.49     -8.23     3.63     -71.38     13.37
*  340.     4.97     -12.66     2.29     -79.03     13.61
*  350.     4.29     -8.20     4.21     30.85     13.85
*  360.     5.29     -7.78     3.92     52.94     14.02
*  370.     6.01     -10.20     2.71     59.84     14.19
*  380.     4.89     -26.26     .48     1.81     14.36
*  390.     2.63     -17.71     1.68     3.88     14.53
*  400.     .75     -13.56     3.39     13.80     14.70
*  410.     .15     -17.70     2.24     37.33     14.91
*  420.     .81     -15.44     2.70     37.92     15.12
*
*****

```



# 1/2"BELOW GP,2"BORDER

CAL FILE 1

DATA FILE 1

DATA FILE 2

CAL FILE 2

NAME:  
THETA:  
PHI:  
SLIDE:  
SOURCE:

TGNTSG1  
-02  
.00  
-69.35  
.01

1D22IN1  
.02  
.01  
96.92  
.03

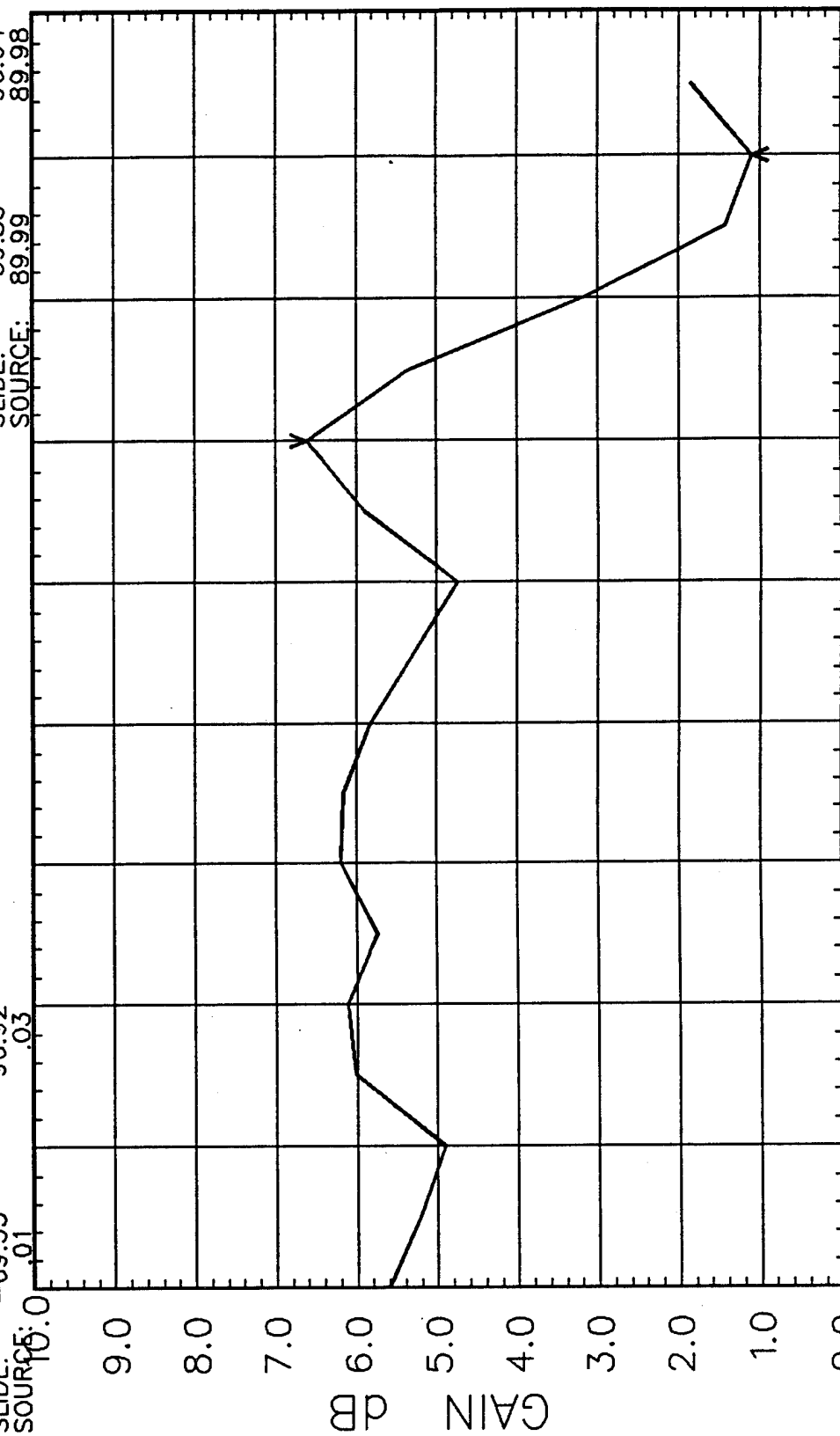
18 NOV 92

NAME:  
THETA:  
PHI:  
SLIDE:  
SOURCE:

TGNTSG3  
-02  
89.97  
-69.35  
89.99

1D22IN2  
.02  
.01  
96.94  
89.98

## TAGGANT



MAX 6.61 AT 370  
MIN 1.09 AT 410

SGH IS AEL 250-500  
BALL AEROSPACE

OUTPUT FILE: TAGGANT

```

*****
*
*               TAGGANT
* 1/2"BELOW GP,2"BORDER      18 NOV 92
* CAL FILE #1 : TGNTSG1
*   THETA ANGLE:  -.02      PHI ANGLE:      .00
*   SLIDE ANGLE: -69.35     SOURCE ANGLE:    .01
*
* CAL FILE #2 : TGNTSG3
*   THETA ANGLE:  -.02      PHI ANGLE:      89.97
*   SLIDE ANGLE: -69.35     SOURCE ANGLE:    89.99
*
* DATA FILE #1 :1D22IN1
*   THETA ANGLE:   .02      PHI ANGLE:      .01
*   SLIDE ANGLE:  96.92     SOURCE ANGLE:    .03
*
* DATA FILE #2 :1D22IN2
*   THETA ANGLE:   .02      PHI ANGLE:      .01
*   SLIDE ANGLE:  96.94     SOURCE ANGLE:    89.98
*
* OUTPUT FILE:   TAGGANT
* GAIN STANDARD: AEL 250-500
*
*****

```

```

*****
*
*   FREQ      RHCP      LHCP      AXIAL      TILT      SGH
*   MHZ      GAIN      GAIN      RATIO      ANGLE      GAIN
*
*   250.      5.60      -3.49      6.37      -84.94      11.30
*   260.      5.21      -.96      9.34      39.51      11.57
*   270.      4.90      -3.64      6.83      -40.68      11.84
*   280.      6.02      -6.04      4.43      24.38      12.11
*   290.      6.11      -5.89      4.46      85.40      12.38
*   300.      5.74      -6.61      4.28      -27.55      12.65
*   310.      6.19      -7.46      3.66      15.49      12.89
*   320.      6.16      -6.95      3.91      70.22      13.13
*   330.      5.83      -9.02      3.18      -64.07      13.37
*   340.      5.29      -13.49      2.01      -74.13      13.61
*   350.      4.74      -8.76      3.73      31.72      13.85
*   360.      5.89      -9.50      2.98      57.16      14.02
*   370.      6.61      -12.21      2.00      63.87      14.19
*   380.      5.36      -19.19      1.03      -14.51      14.36
*   390.      3.19      -16.68      1.77      -.49      14.53
*   400.      1.43      -13.13      3.29      12.78      14.70
*   410.      1.09      -21.23      1.33      39.55      14.91
*   420.      1.85      -17.91      1.79      42.57      15.12
*
*****

```

CAL FILE 1 DATA FILE 1 1/2"BELOW GP,3"BORDER

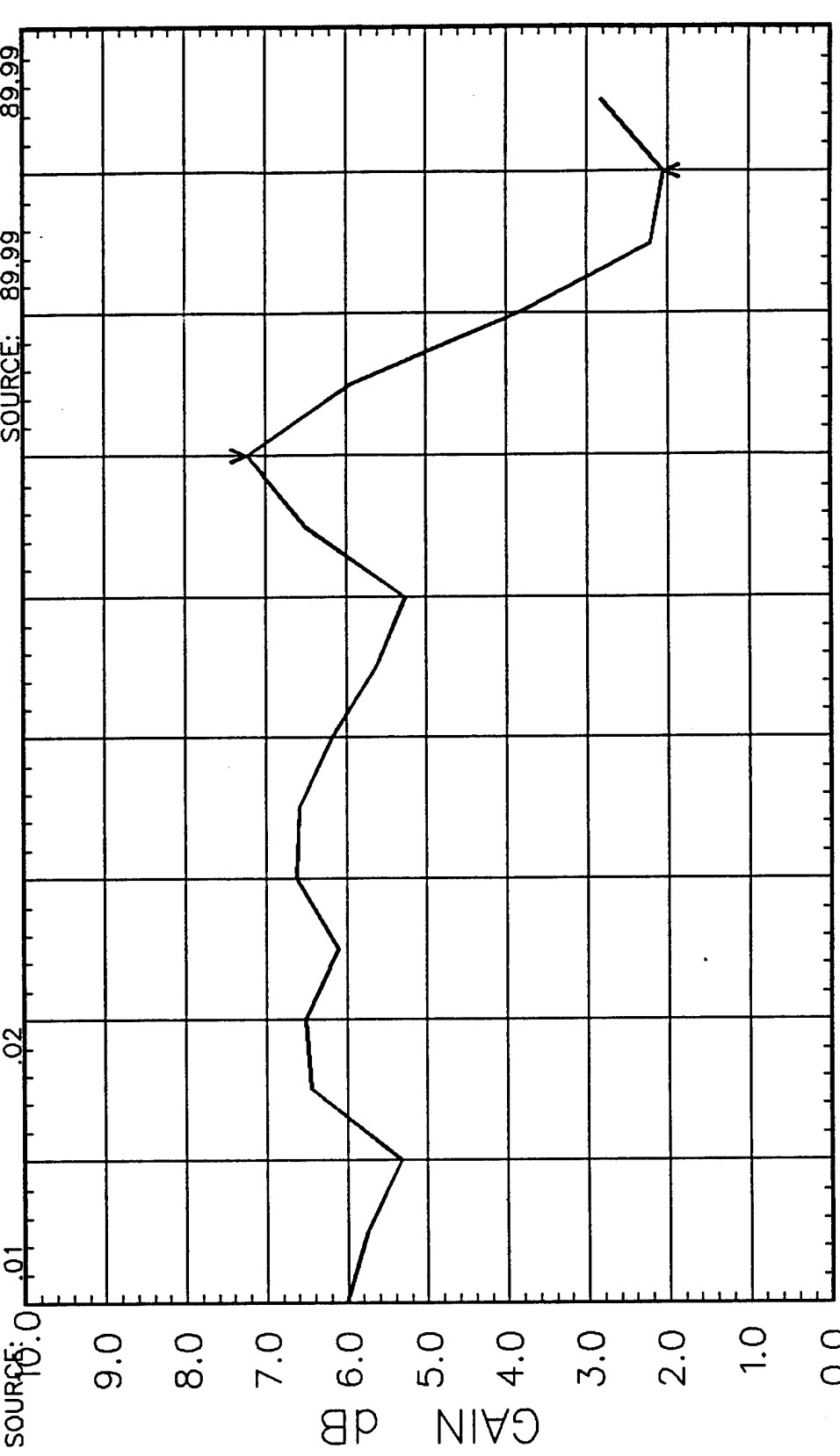
CAL FILE 2 DATA FILE 2

NAME: TGNTSG1  
THETA: -.03  
PHI: -.03  
SLIDE: -69.35  
SOURCE: .01

NAME: TGNTSG3  
THETA: -.02  
PHI: 89.97  
SLIDE: -69.35  
SOURCE: 89.99

18 NOV 92

TAGGANT



MAX 7.23 AT 370  
MIN 2.05 AT 410

FREQUENCY MHz

OUTPUT FILE: TAGGANT

SGH IS AEL 250-500  
BALL AEROSPACE

```

*****
*
*                               TAGGANT
* 1/2"BELOW GP,3"BORDER      18 NOV 92
* CAL FILE #1 : TGNTSG1
*   THETA ANGLE:   -.02      PHI ANGLE:   .00
*   SLIDE ANGLE: -69.35     SOURCE ANGLE: .01
*
* CAL FILE #2 : TGNTSG3
*   THETA ANGLE:   -.02      PHI ANGLE:   89.97
*   SLIDE ANGLE: -69.35     SOURCE ANGLE: 89.99
*
* DATA FILE #1 :1D23IN1
*   THETA ANGLE:   .03      PHI ANGLE:   -.03
*   SLIDE ANGLE:  96.94     SOURCE ANGLE: .02
*
* DATA FILE #2 :1D23IN2
*   THETA ANGLE:   .03      PHI ANGLE:   -.03
*   SLIDE ANGLE:  96.94     SOURCE ANGLE: 89.99
*
* OUTPUT FILE:   TAGGANT
* GAIN STANDARD: AEL 250-500
*
*****
*
*   FREQ      RHCP      LHCP      AXIAL      TILT      SGH
*   MHZ      GAIN      GAIN      RATIO      ANGLE      GAIN
* 250.      6.01      -5.40      4.79      -85.57      11.30
* 260.      5.75      -1.62      7.95      37.71      11.57
* 270.      5.32      -3.66      6.46      -37.98      11.84
* 280.      6.44      -7.44      3.56      24.01      12.11
* 290.      6.51      -6.99      3.73      87.51      12.38
* 300.      6.10      -6.17      4.32      -24.44      12.65
* 310.      6.62      -8.35      3.13      15.09      12.89
* 320.      6.59      -7.88      3.33      72.63      13.13
* 330.      6.18      -8.82      3.12      -57.87      13.37
* 340.      5.63      -13.44      1.94      -67.68      13.61
* 350.      5.26      -9.21      3.32      32.01      13.85
* 360.      6.50      -10.61      2.44      62.87      14.02
* 370.      7.23      -14.18      1.48      72.54      14.19
* 380.      5.94      -14.83      1.59      -21.23      14.36
* 390.      3.84      -15.33      1.92      -6.34      14.53
* 400.      2.20      -12.64      3.18      10.74      14.70
* 410.      2.05      -28.12      .54      49.82      14.91
* 420.      2.83      -21.54      1.05      55.06      15.12
*
*****

```

1/2"BELOW GP,5"BORDER  
18 NOV 92

CAL FILE 1  
TGNTSG1

CAL FILE 2  
TGNTSG3

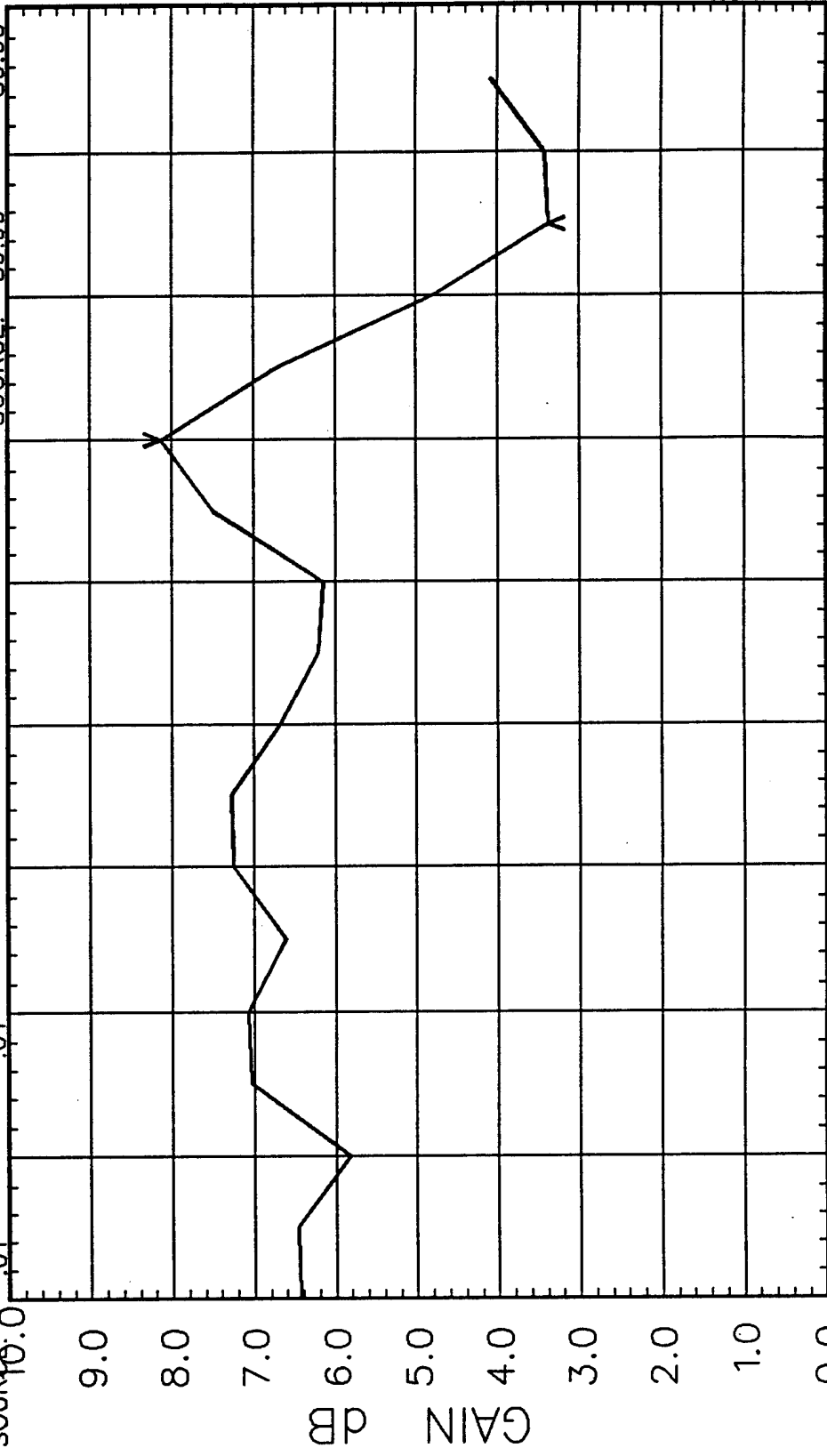
DATA FILE 1  
1D25IN1

DATA FILE 2  
1D25IN2

# TAGGANT

NAME: TGNTSG1  
THETA: -.02  
PHI: .00  
SLIDE: -69.35  
SOURCE: .01

NAME: TGNTSG3  
THETA: -.02  
PHI: 89.97  
SLIDE: -69.35  
SOURCE: 89.99



MAX 8.13 AT 370  
MIN 3.38 AT 400

FREQUENCY MHZ

OUTPUT FILE: TAGGANT

SGH IS AEL 250-500  
BALL AEROSPACE



1/8"BELOW GP,1" BORDER  
18 NOV 92

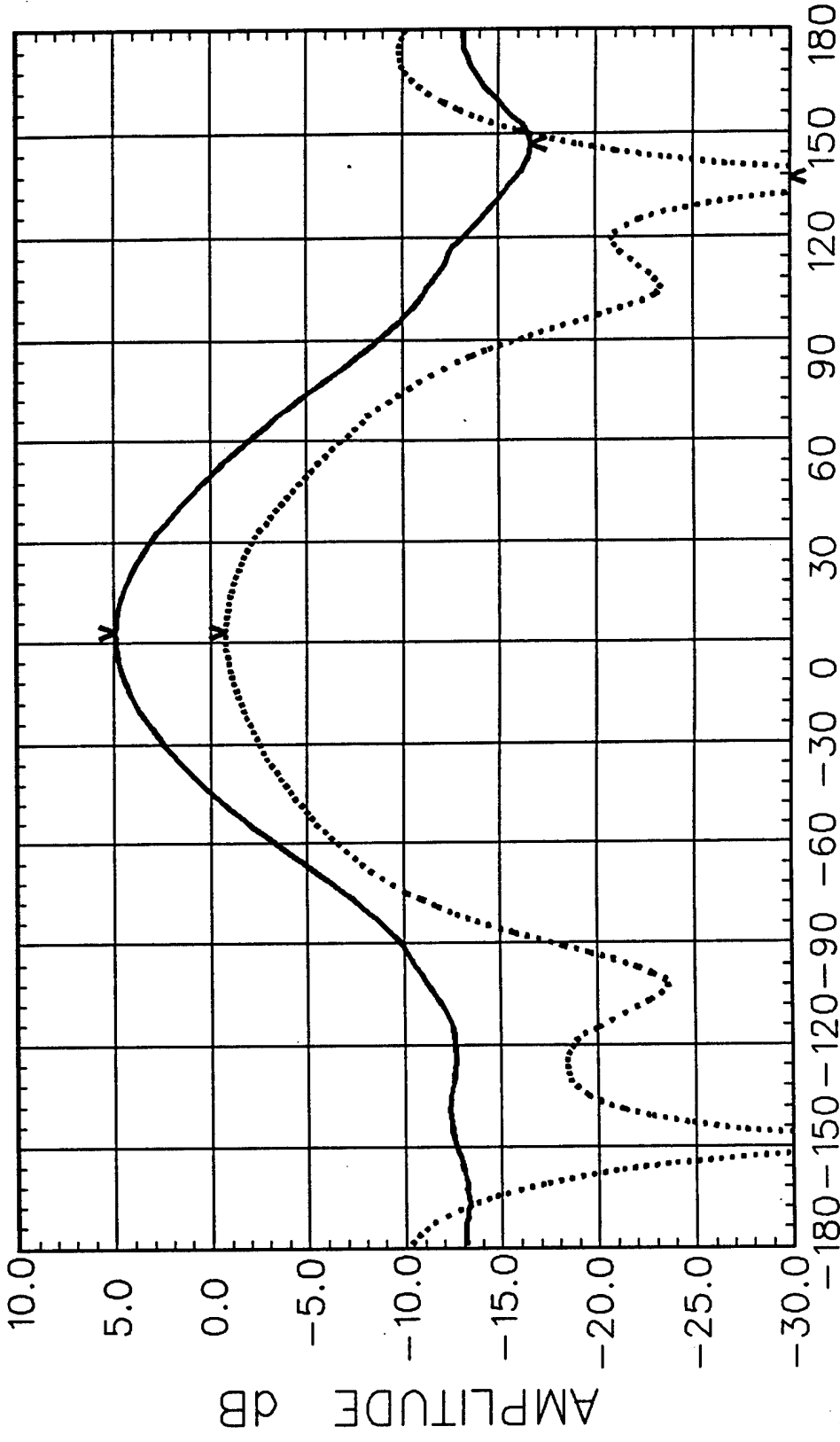
# TAGGANT

BALL AEROSPACE

— is 260MHz RHCP GAIN PHI=  
..... is 260MHz LHCP GAIN PHI=

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

CP6241 HAS 15dB IF ATTEN  
CP6241 HAS 15dB IF ATTEN



THETA ANGLE

— MAX: 4.91dB at 3deg MIN: -16.66dB at 147deg  
..... MAX: -1.80dB at 3deg MIN: -40.80dB at 137deg

1) RFL0118 MAY 92 02174-28 OCT 91  
2) RFL0118 MAY 92 02174-28 OCT 91

1/8"BELOW GP, 1"BORDER  
18 NOV 92

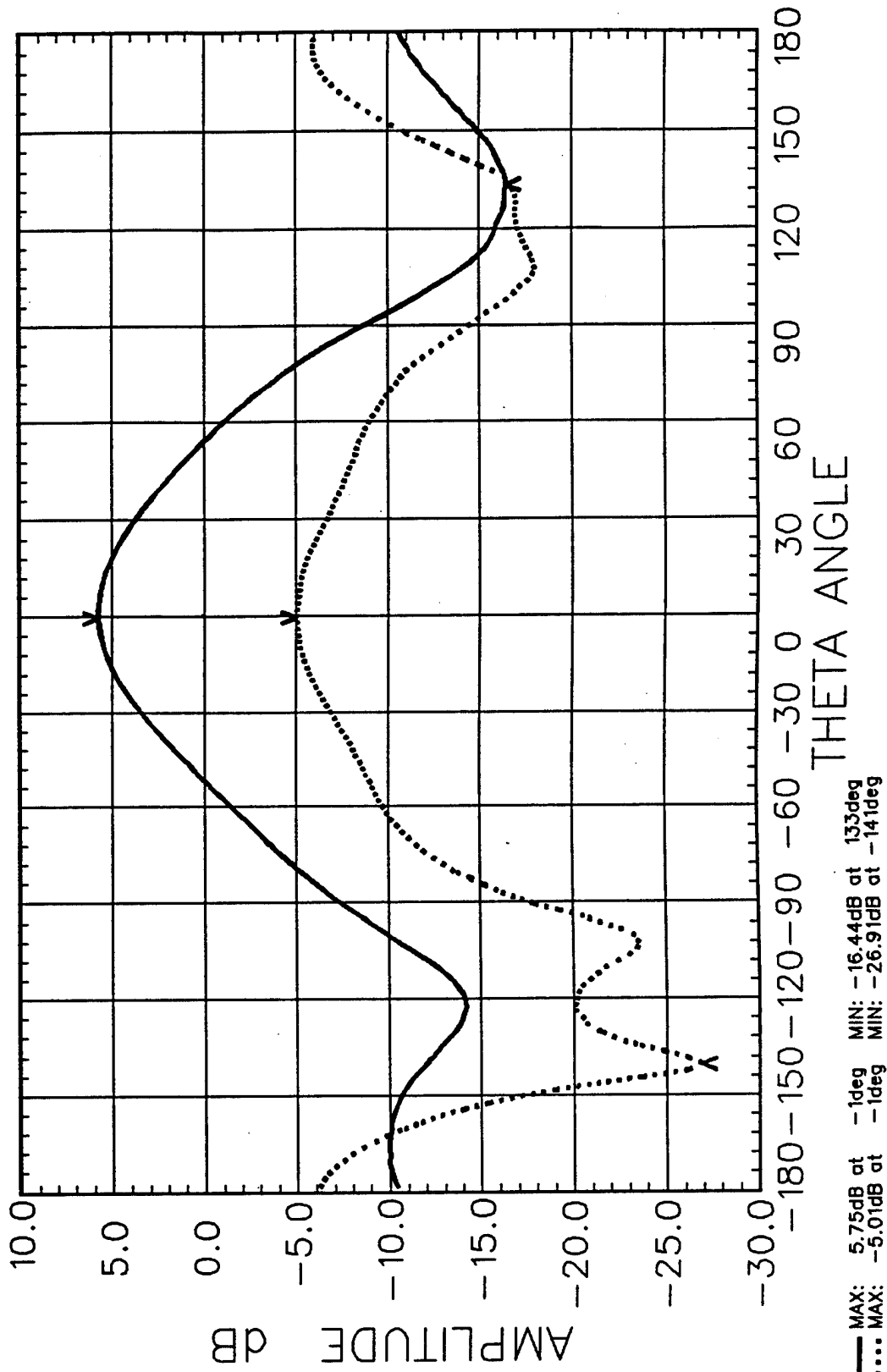
# TAGGANT

— is 290MHz RHCP GAIN PHI=  
..... is 290MHz LHCP GAIN PHI=

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

CP6242 HAS 15dB IF ATTEN  
CP6242 HAS 15dB IF ATTEN

BALL AEROSPACE



1) RPL:19 MAY 92  
2) RPL:19 MAY 92  
CPX:28 OCT 91  
CPX:28 OCT 91



1/8"BELOW GP,1"BORDER  
18 NOV 92

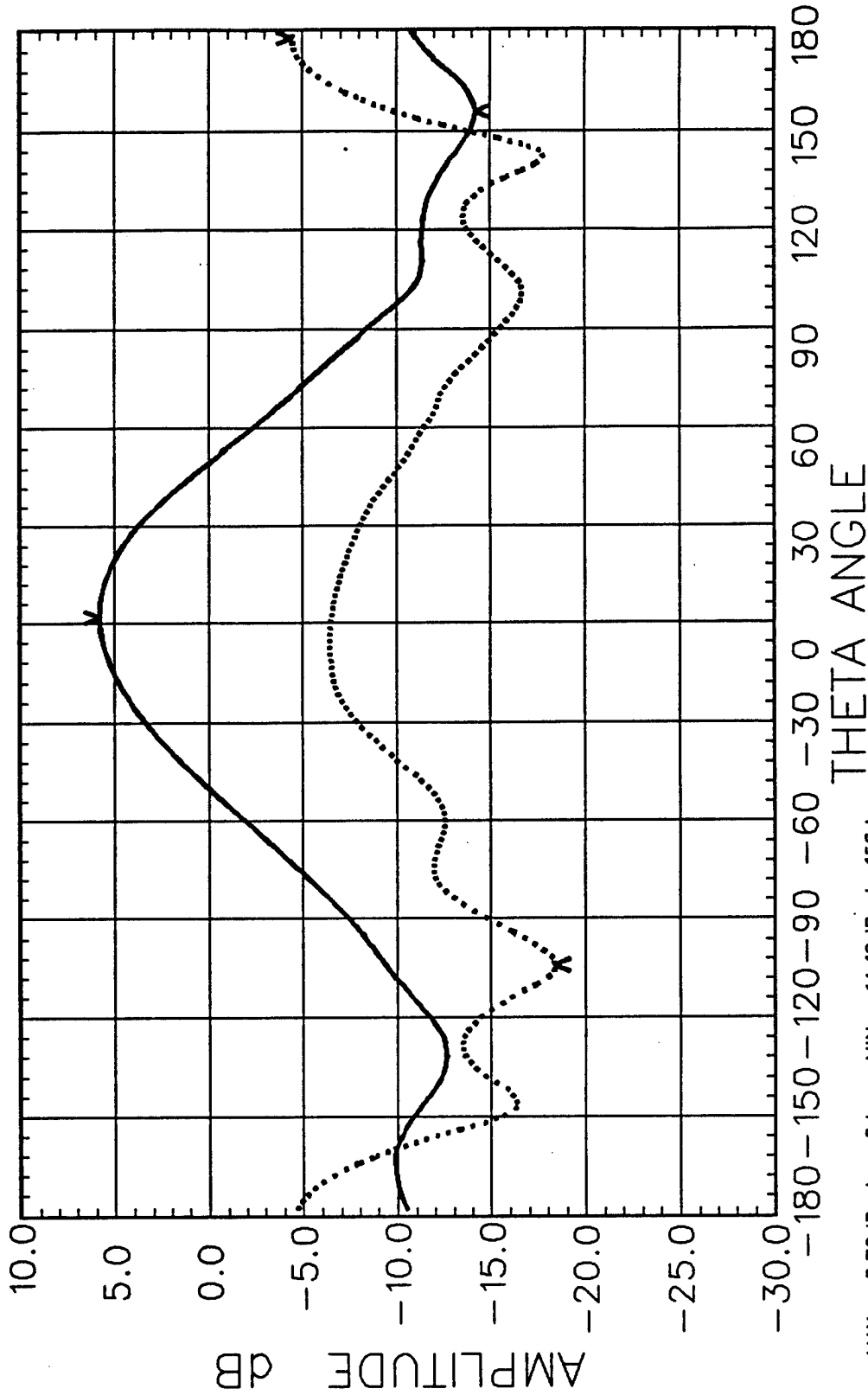
**TAGGANT**

BALL AEROSPACE

CP6243 HAS 15dB IF ATTEN  
CP6243 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

320MHz RHCP GAIN PHI=  
320MHz LHCP GAIN PHI=



MAX: 5.79dB at 2deg MIN: -14.19dB at 156deg  
MAX: -4.46dB at 178deg MIN: -18.37dB at -104deg

2) RFLUT:19 MAY 92  
CP100:28 OCT 91  
CP100:28 OCT 91

1/8"BELOW GP,1"BORDER  
18 NOV 92

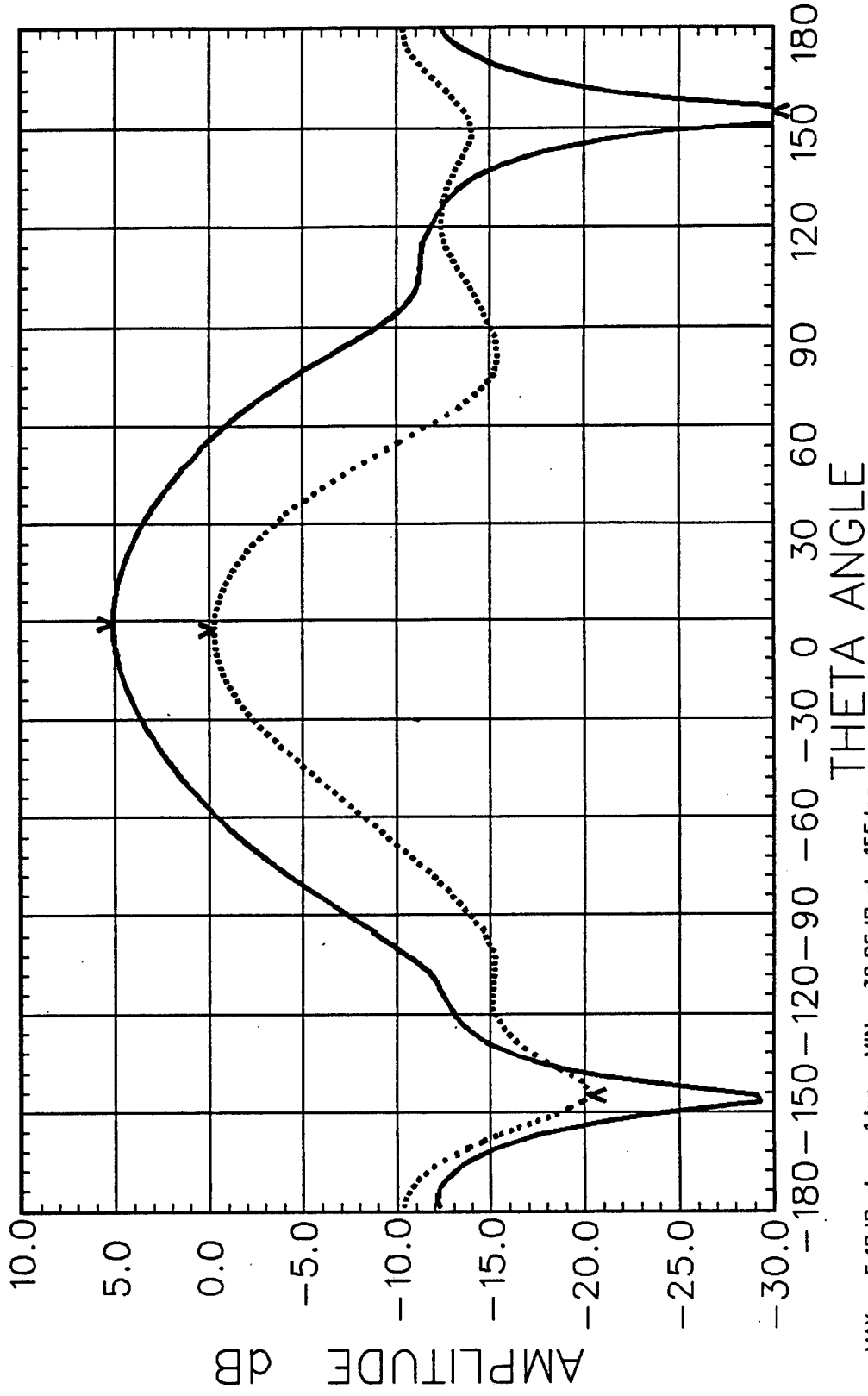
**TAGGANT**

BALL AEROSPACE

CP6261 HAS 15dB IF ATTEN  
CP6261 HAS 15dB IF ATTEN

260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

— is  
..... is



— MAX: 5.10dB at -1deg MIN: -39.06dB at 155deg  
..... MAX: -29dB at -3deg MIN: -20.30dB at -145deg

2) REFLECTOR MAY 92  
CP6261 MAY 92  
CP6261 MAY 92  
CP6261 MAY 92

1/8" BELOW GP, 1" BORDER

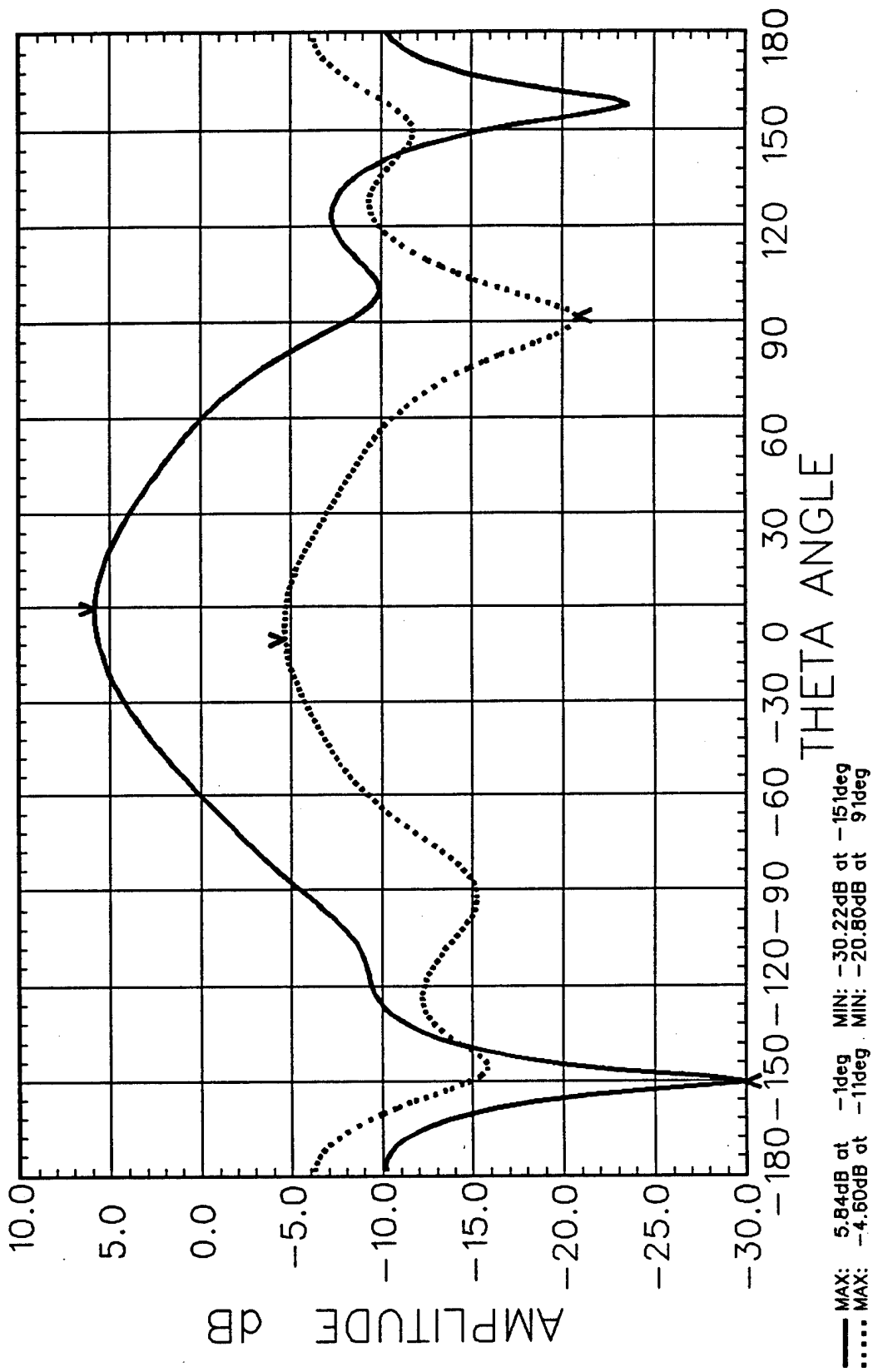
18 NOV 92

— is 290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

**TAGGANT**

CP6262 HAS 15dB IF ATTEN  
CP6262 HAS 15dB IF ATTEN

BALL AEROSPACE



1) RPLD:19 MAY 92 CP6262:28 OCT 91  
2) RPLD:19 MAY 92 CP6262:28 OCT 91

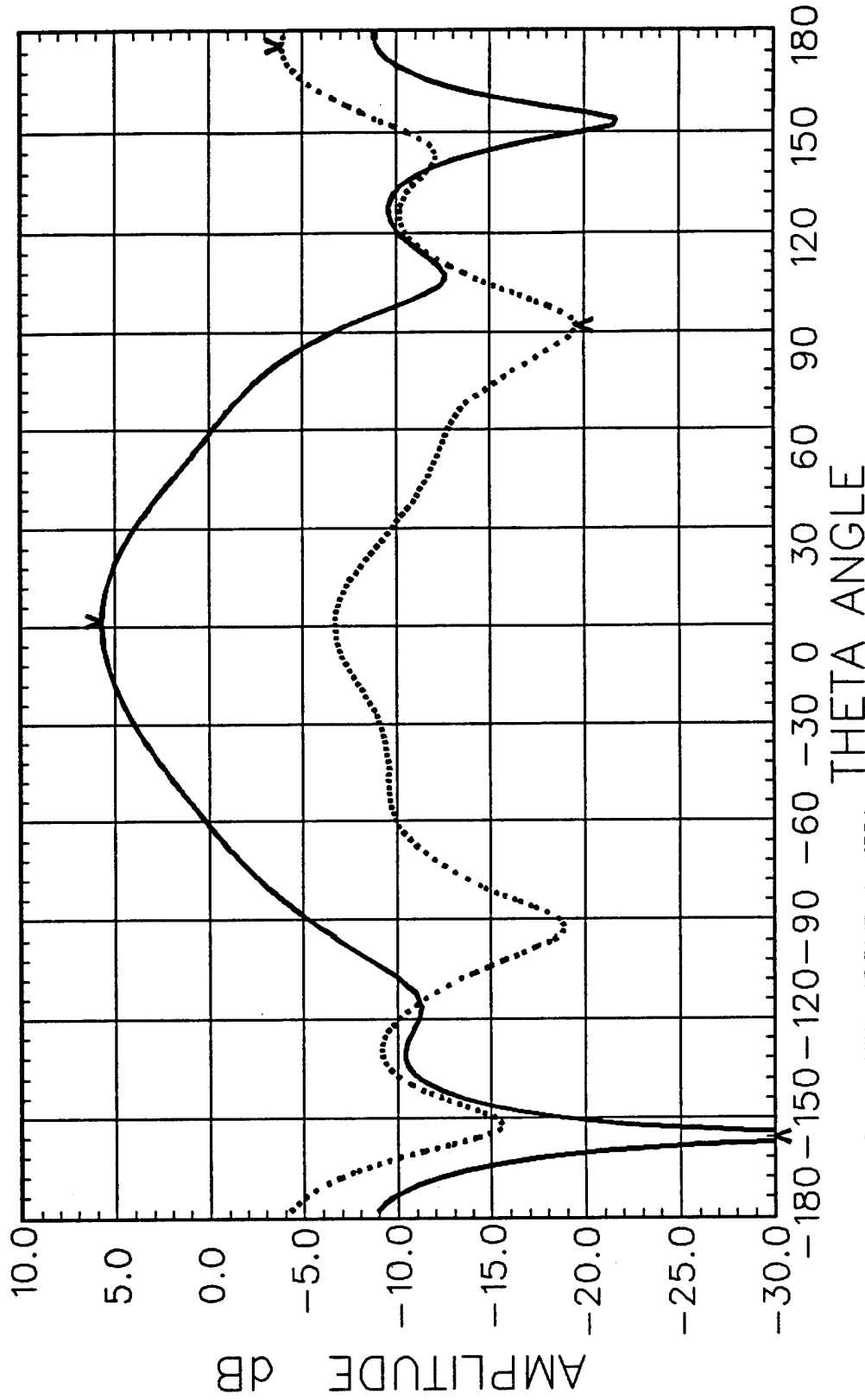
1/8"BELOW GP,1"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6263 HAS 15dB IF ATTEN  
CP6263 HAS 15dB IF ATTEN

— is 320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 5.71dB at 2deg MIN: -40.81dB at -156deg  
..... MAX: -3.87dB at 176deg MIN: -19.65dB at 92deg

2) PLOT: 18 MAY 92  
CP6263 HAS 15dB IF ATTEN  
CP6263 HAS 15dB IF ATTEN

1/8"BELOW GP,2"BORDER

18 NOV 92

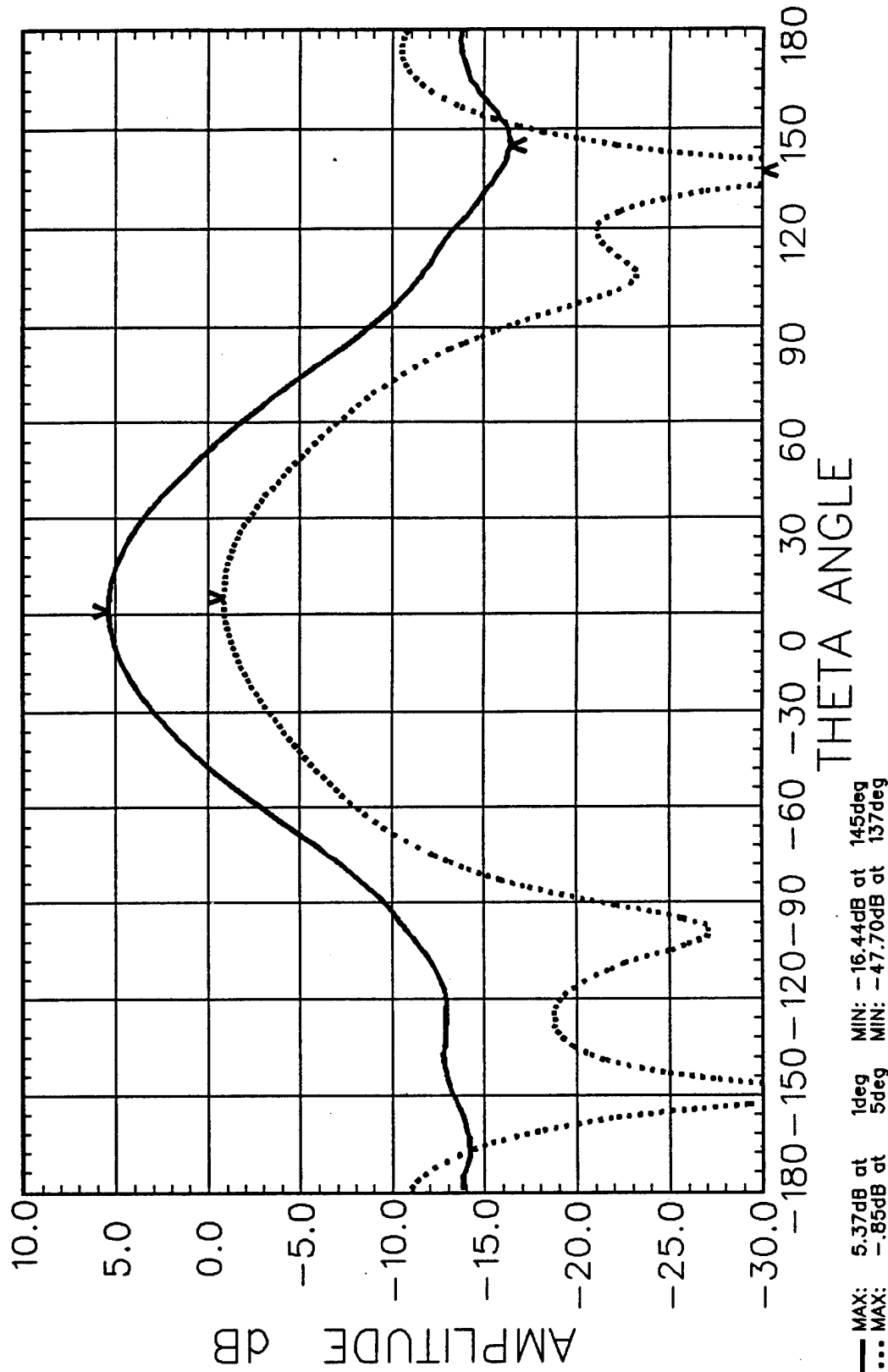
is 260MHz RHCP GAIN PHI=  
..... is 260MHz LHCP GAIN PHI=

# TAGGANT

Odeg ABSOLUTE AMPLITUDE  
Odeg ABSOLUTE AMPLITUDE

CP6281 HAS 15dB IF ATTEN  
CP6281 HAS 15dB IF ATTEN

BALL AEROSPACE



2) REPORT: 18 MAY 92  
3) REPORT: 19 MAY 92  
CP6281-28 OCT 81

1/8"BELOW GP,2"BORDER

# TAGGANT

## BALL AEROSPACE

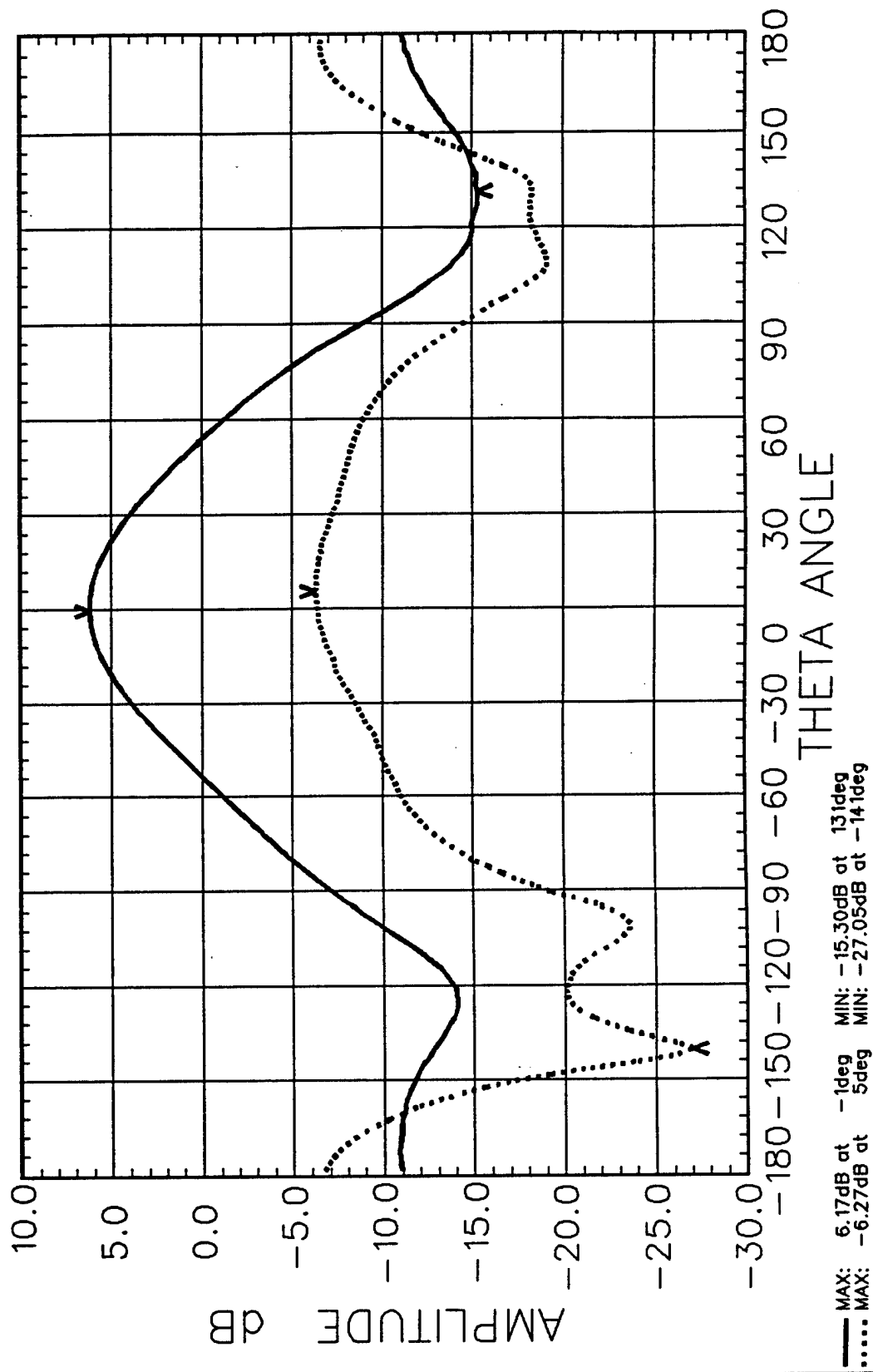
18 NOV 92

— is 290MHz RHCP GAIN PHI=  
 .... is 290MHz LHCP GAIN PHI=

CP6282 HAS 15dB IF ATTEN  
CP6282 HAS 15dB IF ATTEN

Udeg ABSOLUTE AMPLITUDE  
Odeg ABSOLUTE AMPLITUDE

CP6282 HAS 15dB IF ATTEN



—	MAX:	6.17dB at	-1deg	MIN:	-15.30dB at	131deg
.....	MAX:	-6.27dB at	5deg	MIN:	-27.05dB at	-141deg

MAX:	6.17dB at	MIN:	-27.05dB at
MAX:	-6.27dB at	MIN:	-27.05dB at
			-14.1deg

1/8"BELOW GP.2"BORDER  
18 NOV 92

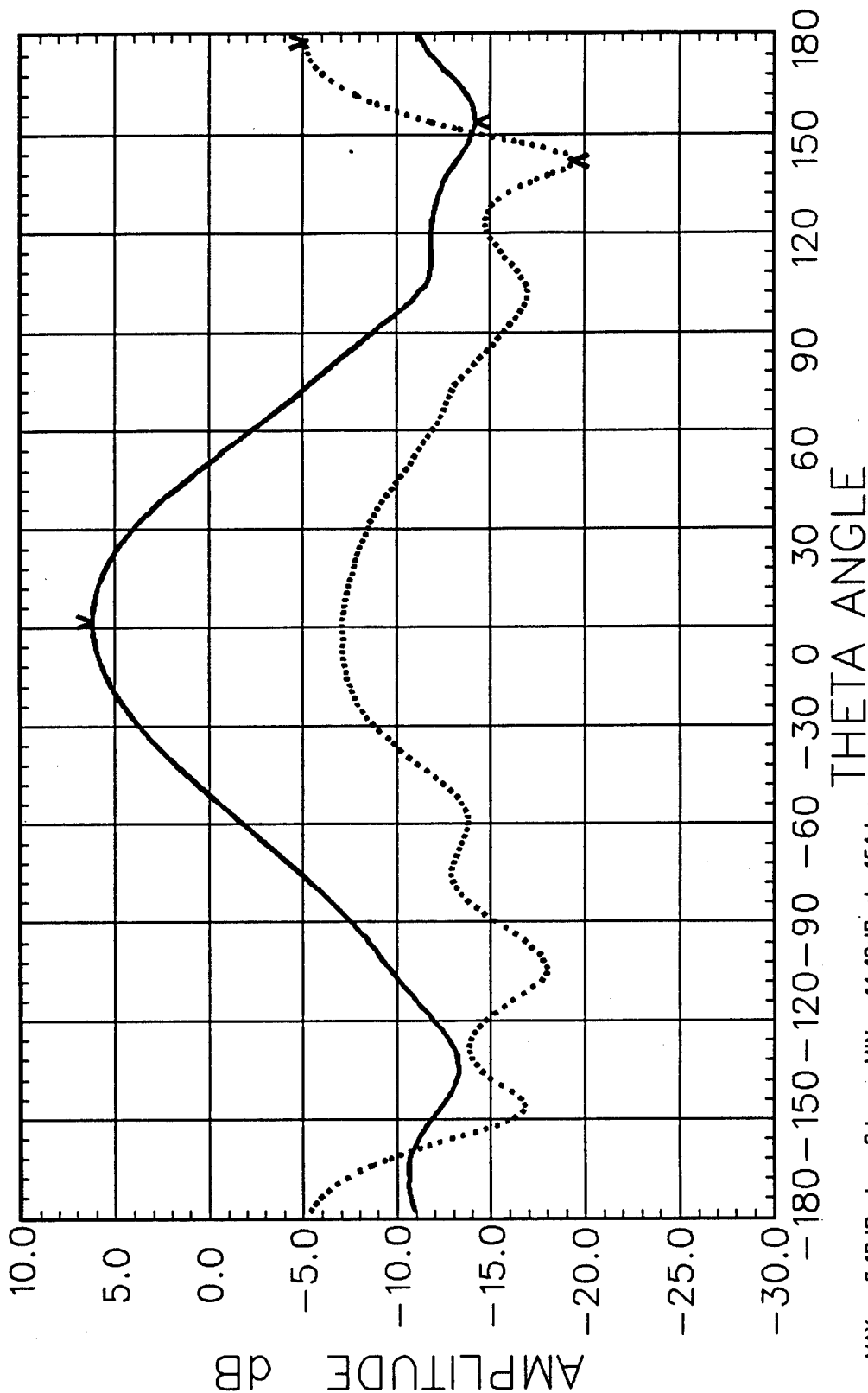
# TAGGANT

BALL AEROSPACE

— is 320MHz RHCP GAIN PHI=  
..... is 320MHz LHCP GAIN PHI=

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

CP6283 HAS 15dB IF ATTN  
CP6283 HAS 15dB IF ATTN



MAX: 6.18dB at 2deg MIN: -14.19dB at 154deg  
MAX: -5.15dB at 178deg MIN: -19.39dB at 142deg

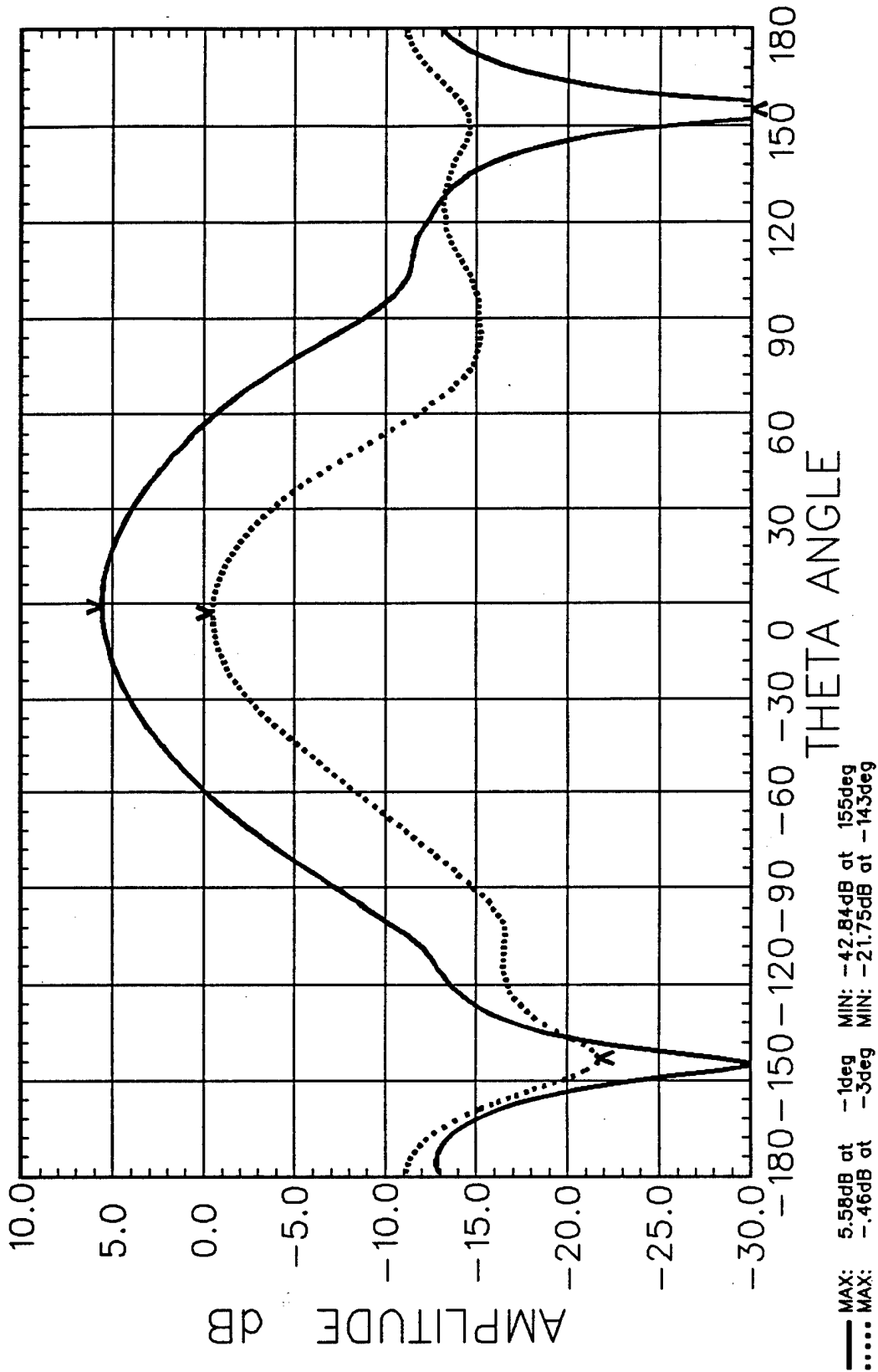
1/8"BELOW GP,2"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

— is 260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

CP6301 HAS 15dB IF ATTEN  
CP6301 HAS 15dB IF ATTEN



1) REPT:19 MAY 92 CPX:28 OCT 91  
2) REPT:19 MAY 92 CPX:28 OCT 91



1/8"BELOW GP,2"BORDER

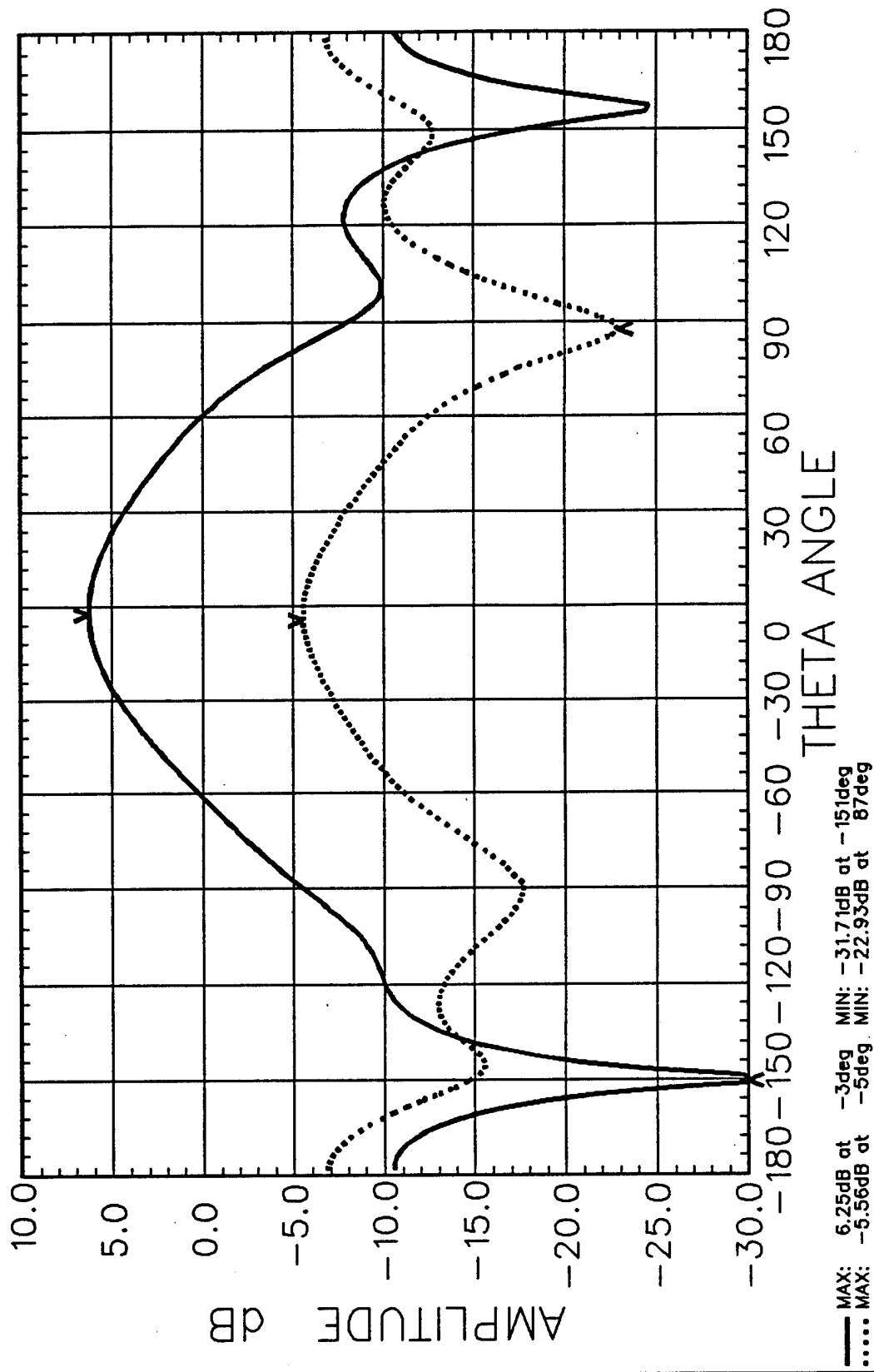
18 NOV 92

**TAGGANT**

— is 290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

CP6302 HAS 15dB IF ATTEN  
CP6302 HAS 15dB IF ATTEN

BALL AEROSPACE



1) RPL:19 MAY 92  
2) RPL:19 MAY 92  
CP6302:28 OCT 91  
CP6302:28 OCT 91

1/8"BELOW GP,2"BORDER

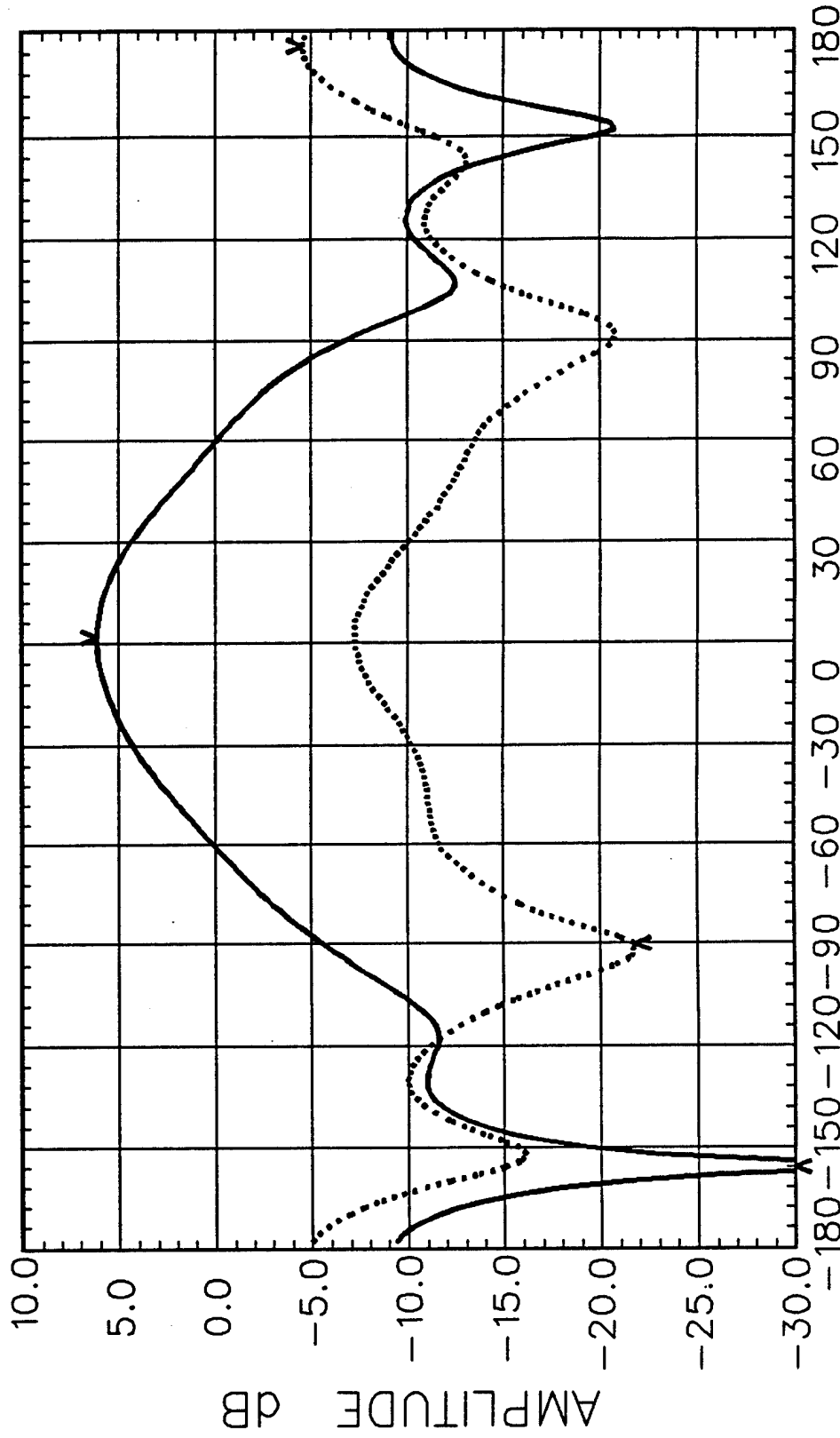
18 NOV 92

— is 320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

**TAGGANT**

CP6303 HAS 15dB IF ATTEN  
CP6303 HAS 15dB IF ATTEN

BALL AEROSPACE



— MAX: 6.12dB at 2deg MIN: -36.86dB at -156deg  
..... MAX: -4.54dB at 176deg MIN: -21.78dB at -90deg

REF: 18 MAY 92  
CP6303 HAS 15dB IF ATTEN  
CP6303 HAS 15dB IF ATTEN  
CP6303 HAS 15dB IF ATTEN

1/8"BELOW GP,3"BORDER  
18 NOV 92

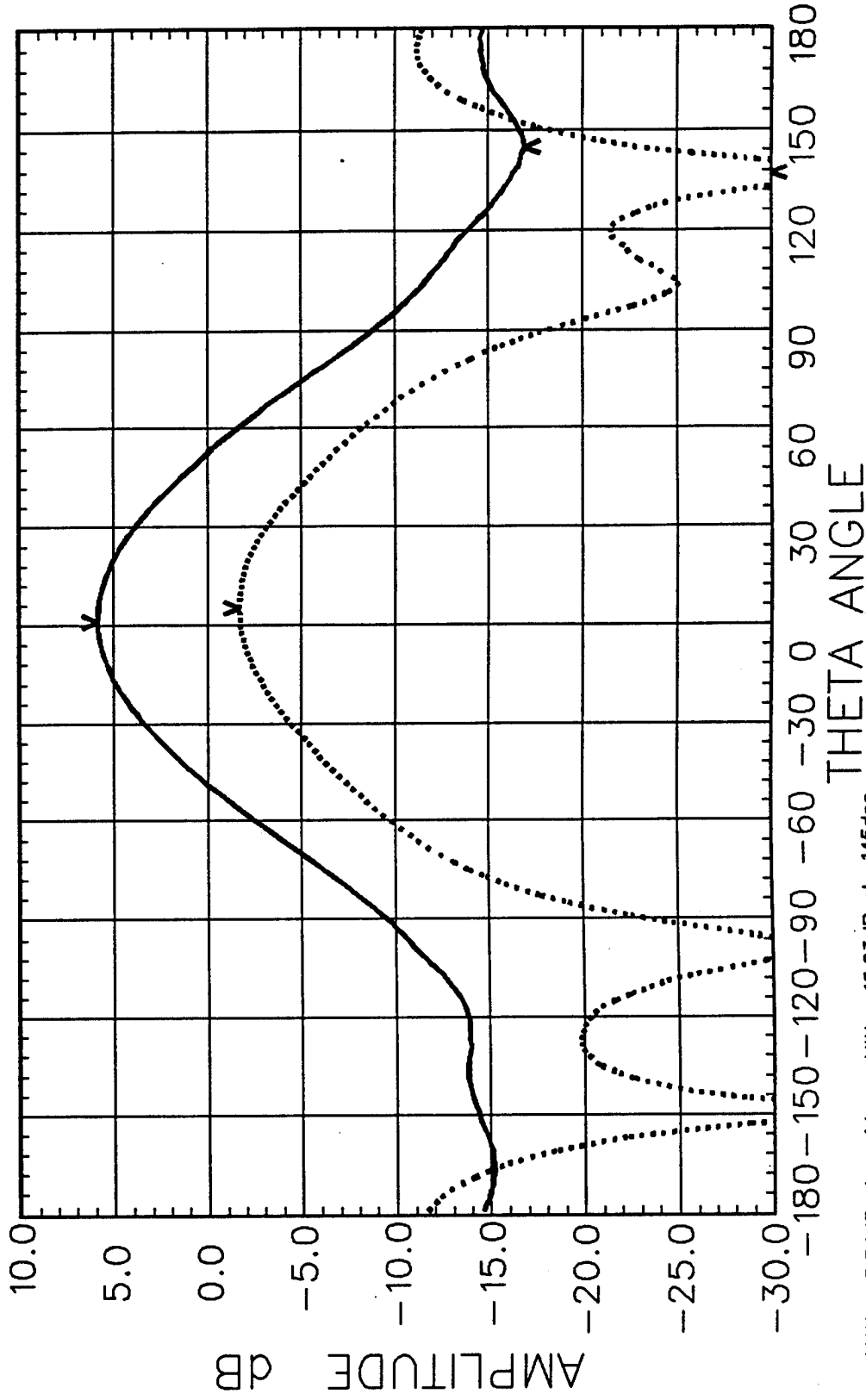
# TAGGANT

BALL AEROSPACE

CP6321 HAS 15dB IF ATTEN  
CP6321 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

is 260MHz RHCP GAIN PHI=  
is 260MHz LHCP GAIN PHI=



MAX: 5.84dB at 1deg MIN: -16.93dB at 145deg  
MAX: -1.69dB at 5deg MIN: -40.04dB at 137deg

2) REFLECTOR MAY 92  
3) REFLECTOR MAY 92  
4) REFLECTOR MAY 92  
5) REFLECTOR MAY 92

1/8"BELOW GP,3"BORDER  
18 NOV 92

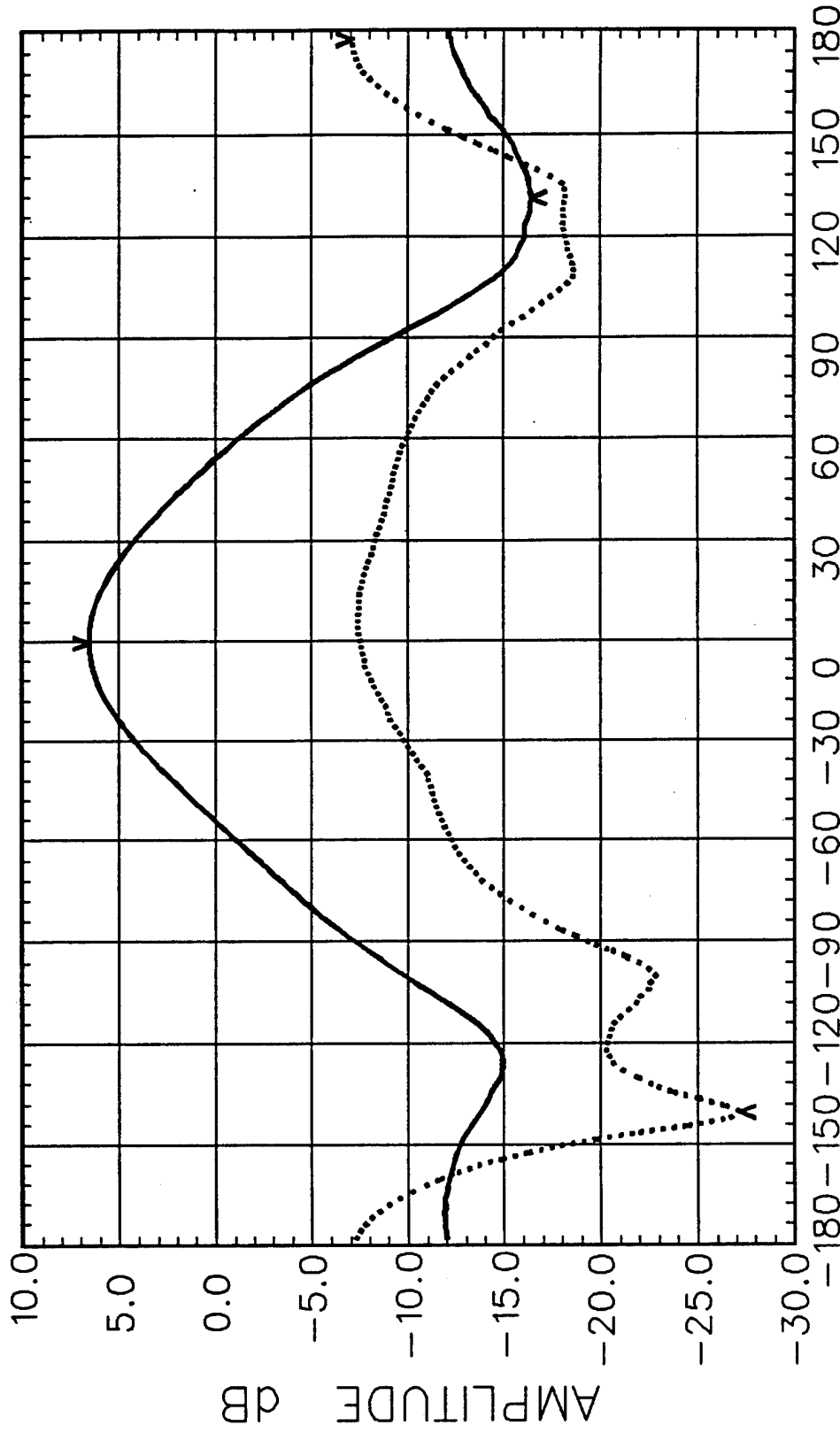
**TAGGANT**

BALL AEROSPACE

CP6322 HAS 15dB IF ATTEN  
CP6322 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

is 290MHz RHCP GAIN PHI=  
is 290MHz LHCP GAIN PHI=



MAX: 6.54dB at -1deg MIN: -16.43dB at 131deg  
MAX: -7.10dB at 177deg MIN: -27.19dB at -141deg

2) RFL: 19 MAY 92  
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100) RFL: 19 MAY 92

1/8"BELOW GP.3"BORDER

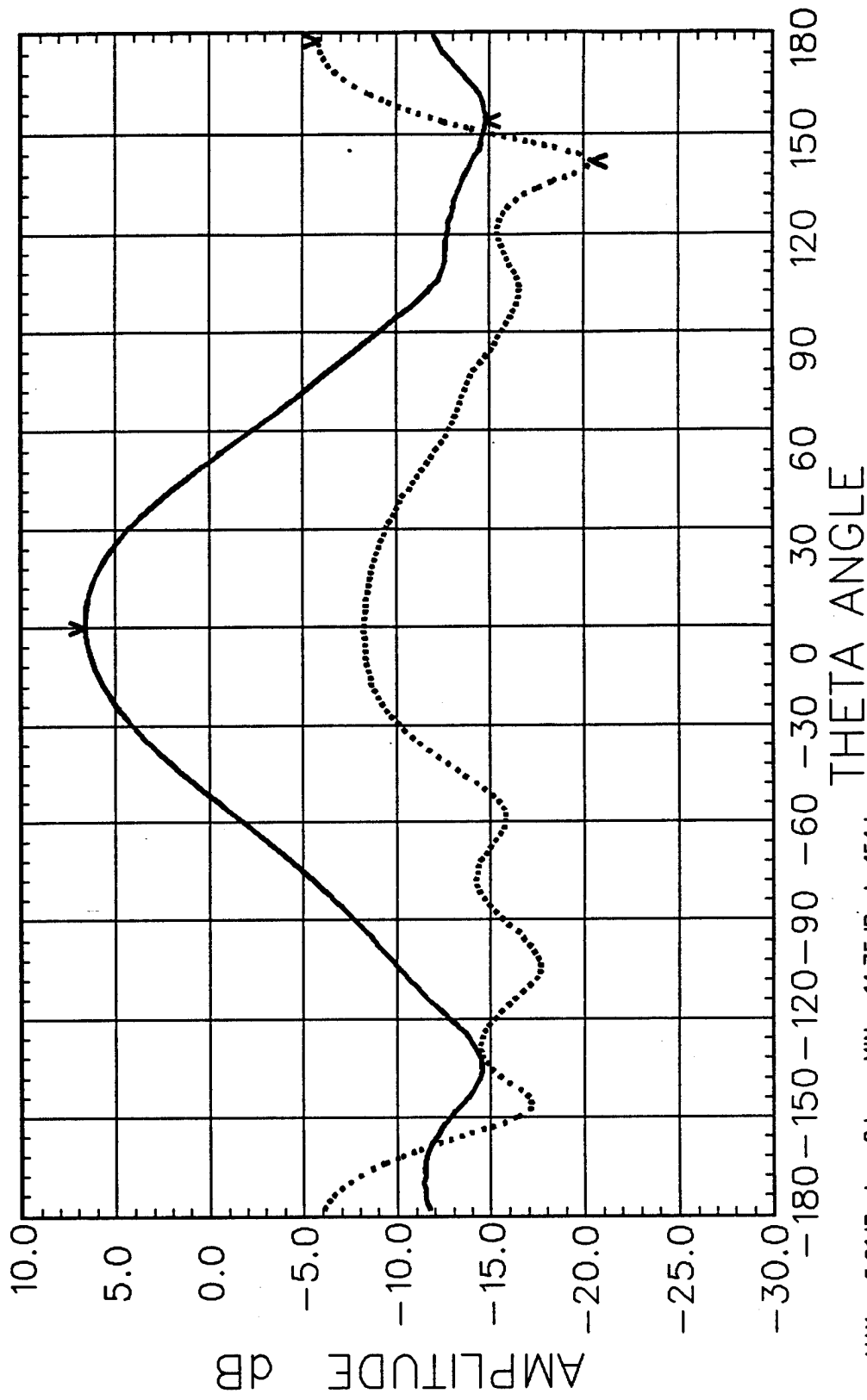
**TAGGANT**

BALL AEROSPACE

18 NOV 92

is 320MHz RHCP GAIN PHI= 0deg  
..... is 320MHz LHCP GAIN PHI= 0deg

CP6323 HAS 15dB IF ATTEN  
CP6323 HAS 15dB IF ATTEN



— MAX: 6.61dB at 0deg MIN: -14.75dB at 154deg  
..... MAX: -5.87dB at 178deg MIN: -20.44dB at 142deg

1) RFL07:18 MAY 92 CPXFM:28 OCT 91  
2) RFL07:18 MAY 92 CPXFM:28 OCT 91

1/8"BELOW GP,3"BORDER  
18 NOV 92

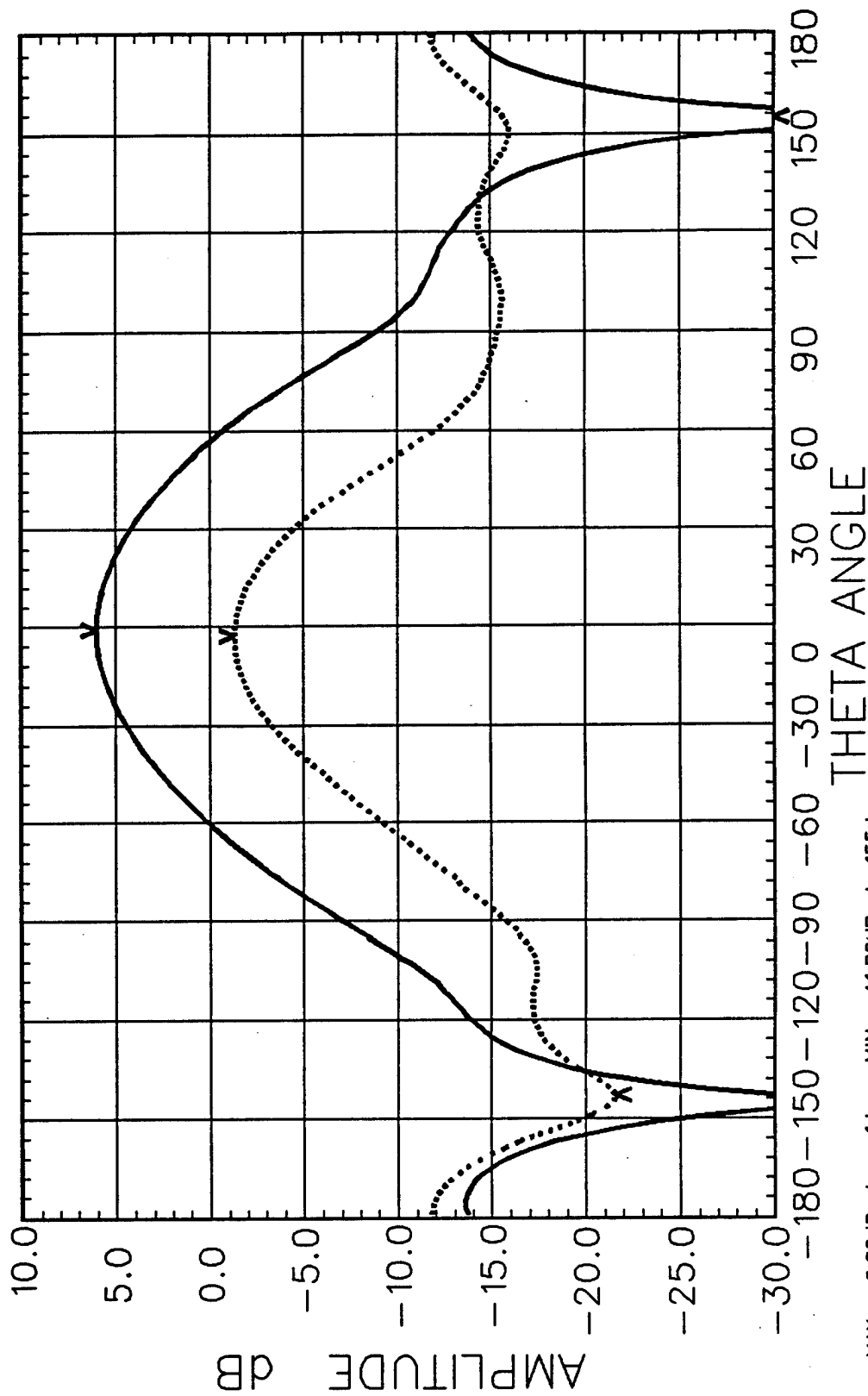
# TAGGANT

BALL AEROSPACE

CP6341 HAS 15dB IF ATTEN  
CP6341 HAS 15dB IF ATTEN

260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

— is  
..... is



MAX: 6.02dB at -1deg MIN: -41.89dB at 155deg  
MAX: -1.33dB at -3deg MIN: -21.59dB at -143deg

1) PLOT: 18 MAY 92  
2) PLOT: 28 OCT 91

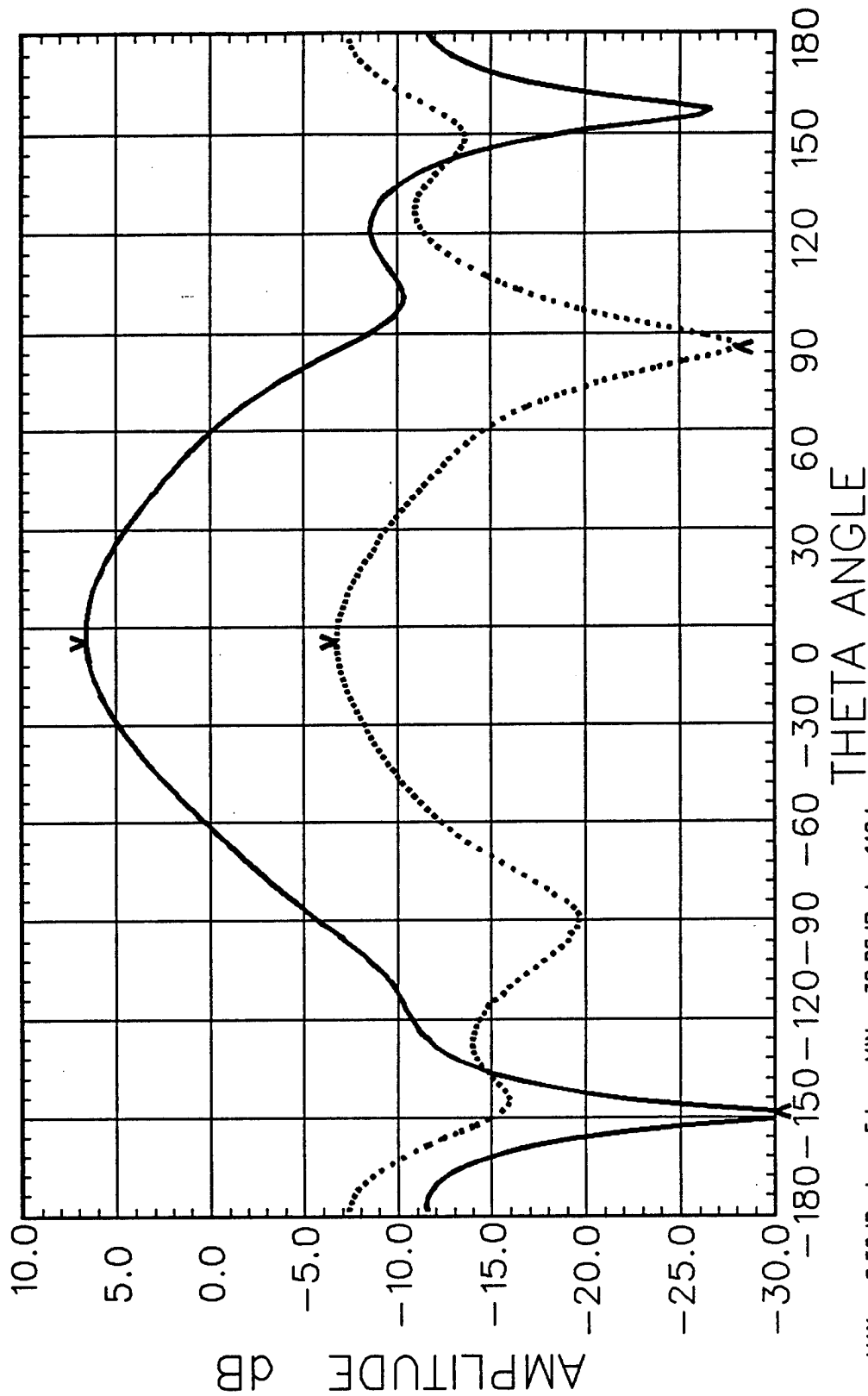
1/8"BELOW GP,3"BORDER  
18 NOV 92

**TAGGANT**

BALL AEROSPACE

CP6342 HAS 15dB IF ATTEN  
CP6342 HAS 15dB IF ATTEN

— is 290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 6.59dB at -5deg MIN: -30.86dB at -149deg  
..... MAX: -6.74dB at -5deg MIN: -28.09dB at 85deg

1) RFLUT:18 MAY 92  
2) RFLUT:18 MAY 92  
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1/8"BELOW GP.3"BORDER

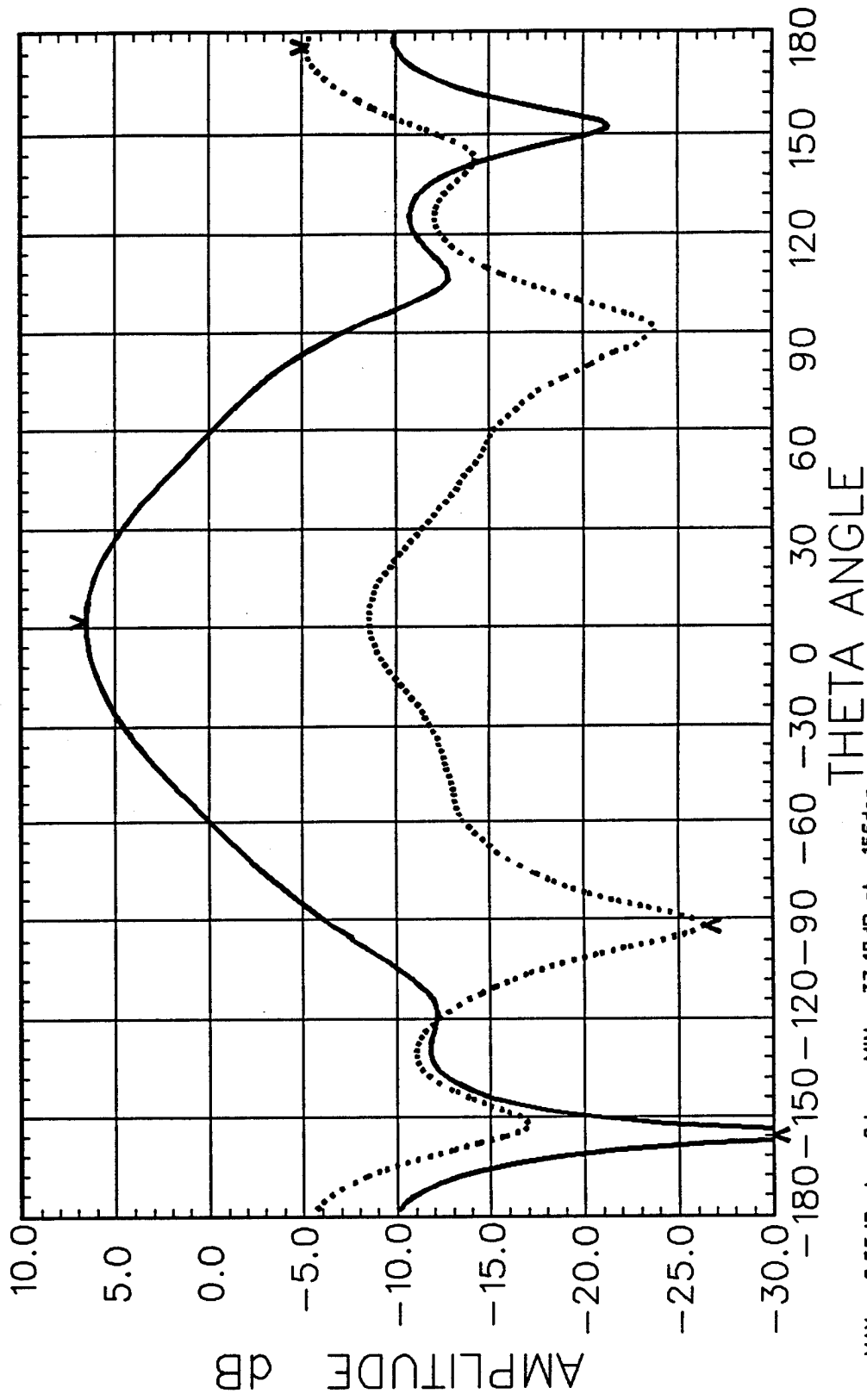
**TAGGANT**

BALL AEROSPACE

18 NOV 92

is 320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

CP6343 HAS 15dB IF ATTEN  
CP6343 HAS 15dB IF ATTEN



MAX: 6.55dB at 2deg MIN: -37.18dB at -156deg  
MAX: -5.24dB at 176deg MIN: -26.42dB at -92deg

CP6343 HAS 15dB IF ATTEN  
CP6343 HAS 15dB IF ATTEN  
CP6343 HAS 15dB IF ATTEN  
CP6343 HAS 15dB IF ATTEN



1/8"BELOW GP.5"BORDER

**TAGGANT**

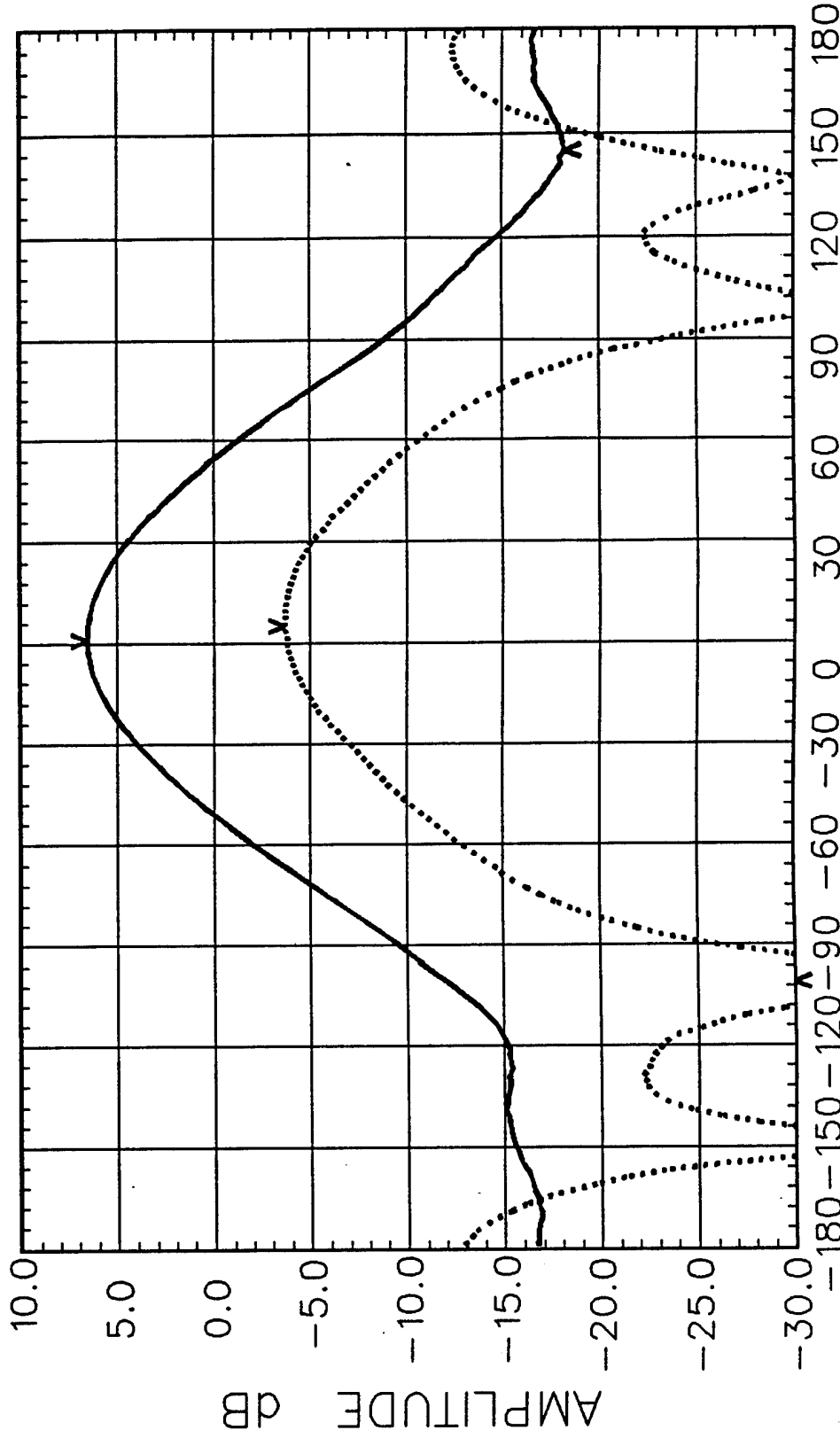
BALL AEROSPACE

18 NOV 92

— is 260MHz RHCP GAIN PHI=  
..... is 260MHz LHCP GAIN PHI=

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

CP6361 HAS 15dB IF ATTEN  
CP6361 HAS 15dB IF ATTEN



— MAX: 6.55dB at 1deg MIN: -18.24dB at 145deg  
..... MAX: -3.67dB at 5deg MIN: -54.80dB at -101deg

2) RFLD:19 MAY 92  
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1/8"BELOW GP,5"BORDER  
18 NOV 92

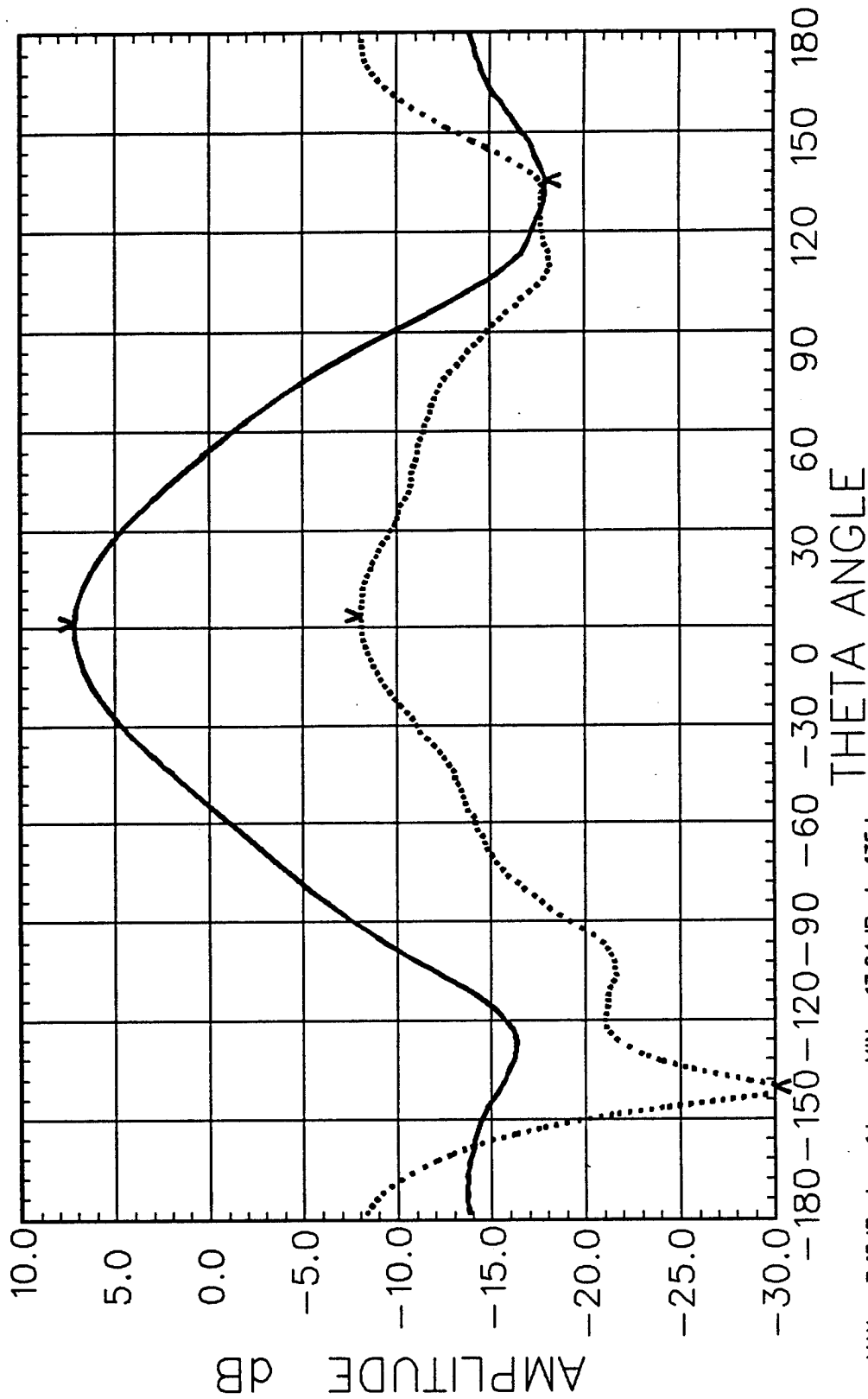
# TAGGANT

BALL AEROSPACE

CP6362 HAS 15dB IF ATTEN  
CP6362 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

is 290MHz RHCP GAIN PHI=  
..... is 290MHz LHCP GAIN PHI=



MAX: 7.15dB at 1deg MIN: -17.94dB at 135deg  
MAX: -8.09dB at 3deg MIN: -30.60dB at -14deg

1. RPL01:19 MAY 92  
2. RPL01:19 MAY 92  
3. RPL01:19 MAY 92  
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10. RPL01:19 MAY 92  
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12. RPL01:19 MAY 92  
13. RPL01:19 MAY 92  
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95. RPL01:19 MAY 92  
96. RPL01:19 MAY 92  
97. RPL01:19 MAY 92  
98. RPL01:19 MAY 92  
99. RPL01:19 MAY 92  
100. RPL01:19 MAY 92

1/8"BELOW GP,5"BORDER  
18 NOV 92

# TAGGANT

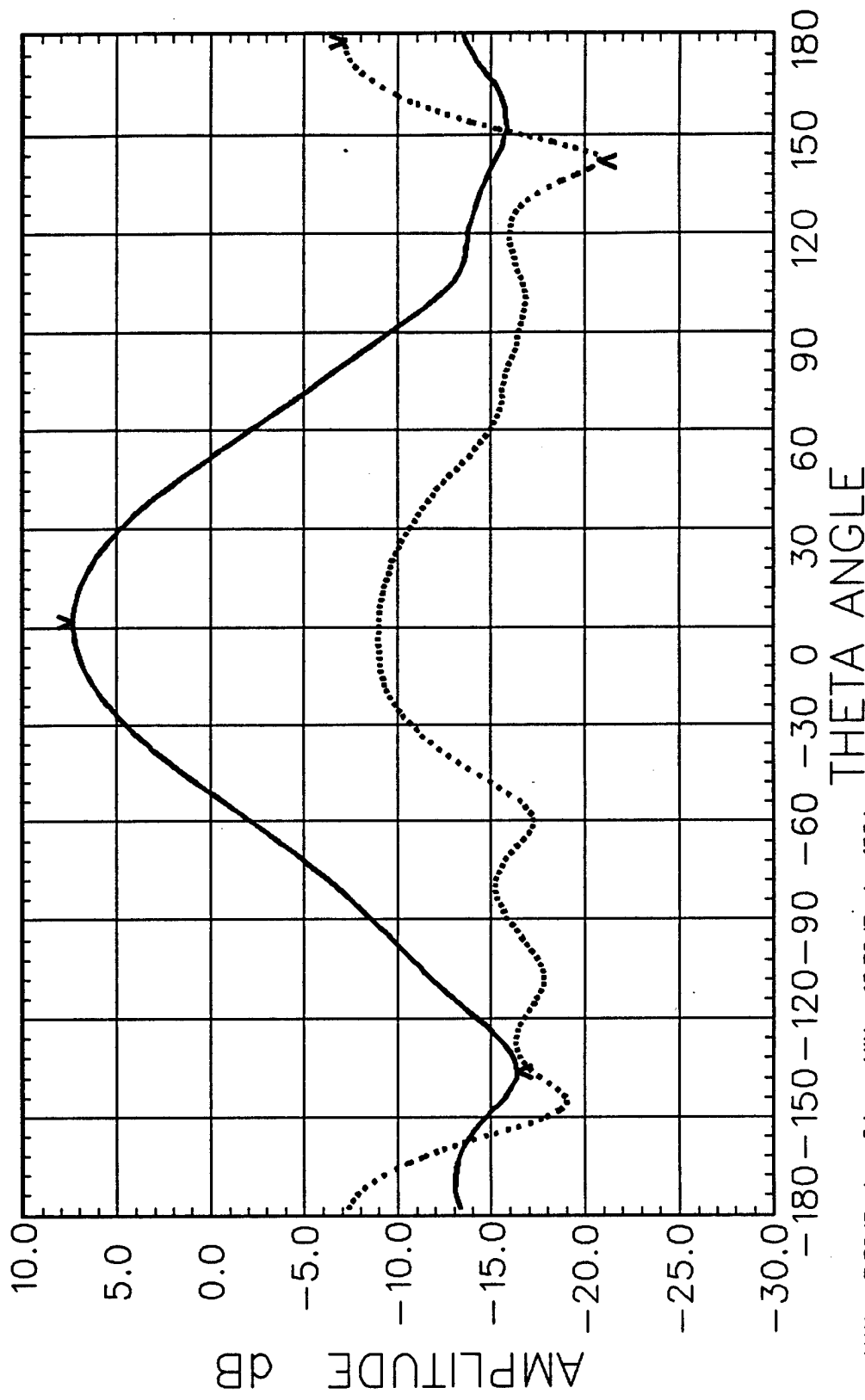
BALL AEROSPACE

CP6363 HAS 15dB IF ATTEN  
CP6363 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

320MHz RHCP GAIN PHI=  
320MHz LHCP GAIN PHI=

is  
is



MAX: 7.32dB at 2deg MIN: -16.39dB at -136deg  
MAX: -7.18dB at 178deg MIN: -20.84dB at 142deg

2) RFLUT:18 MAY 92  
CP6363:28 OCT 91  
CP6363:28 OCT 91

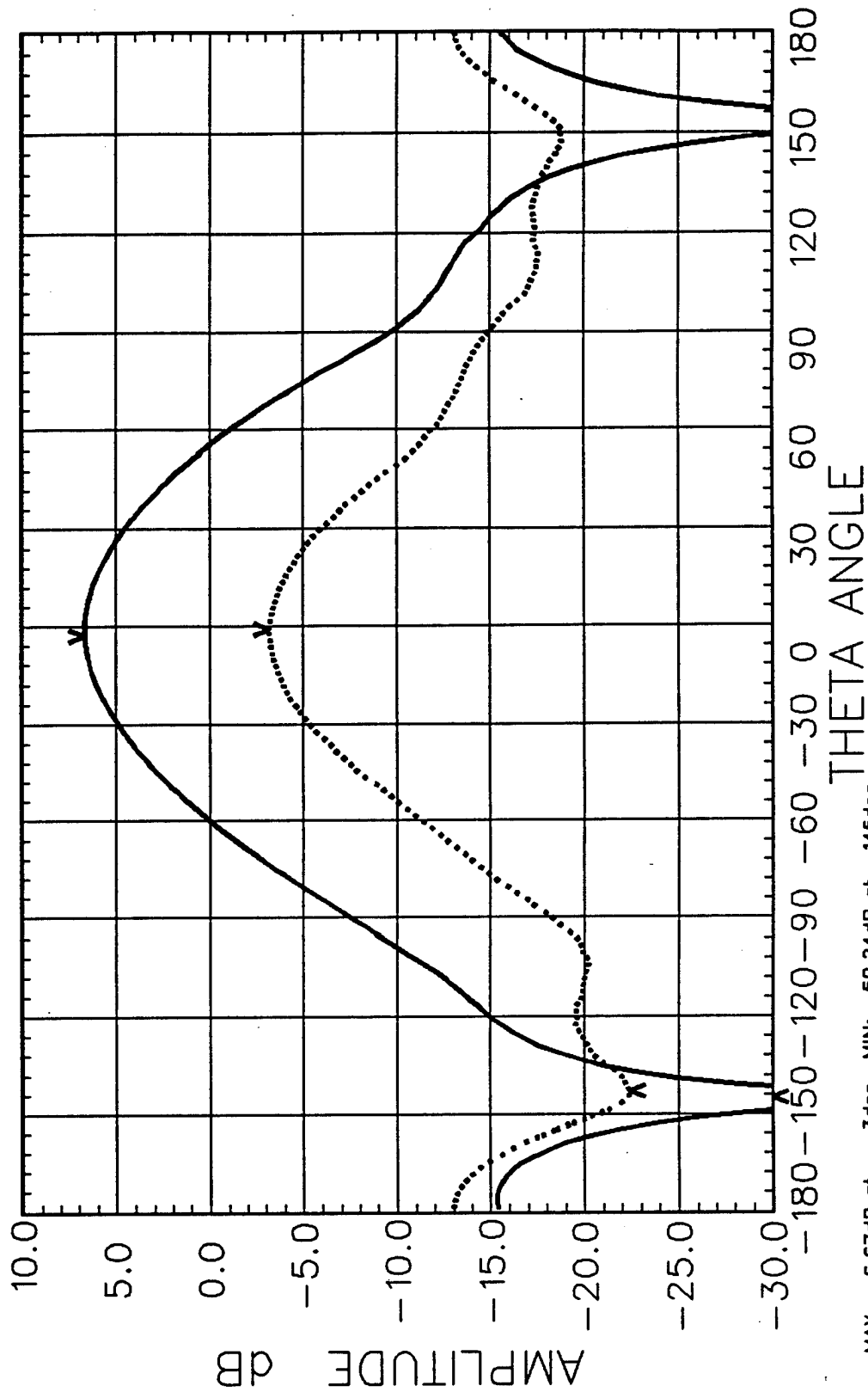
1/8"BELOW GP,5"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6381 HAS 15dB IF ATTEN  
CP6381 HAS 15dB IF ATTEN

— is 260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 6.67dB at -3deg MIN: -50.24dB at -145deg  
..... MAX: -3.19dB at -1deg MIN: -22.42dB at -143deg

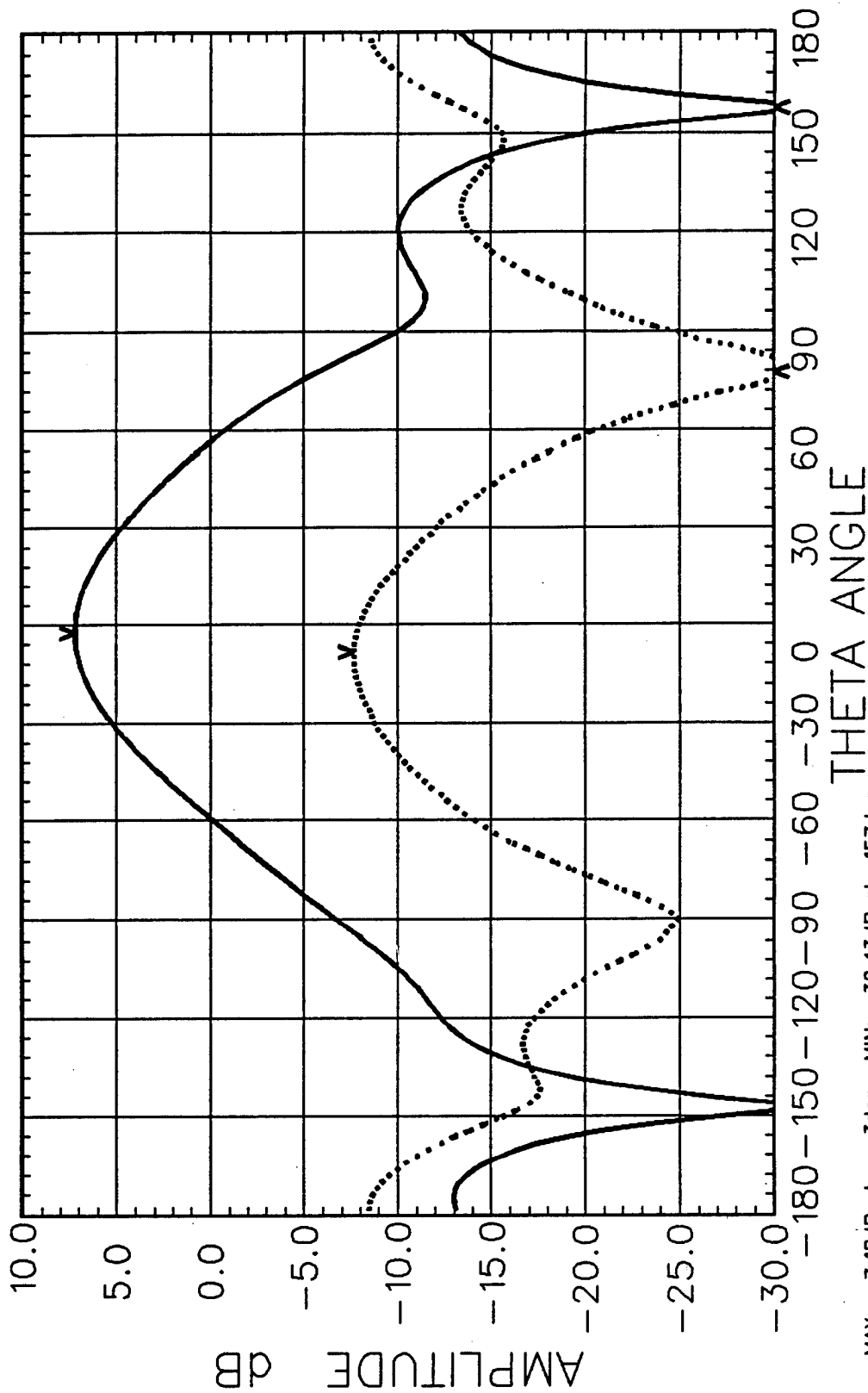
1/8"BELOW GP,5"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6382 HAS 15dB IF ATTEN  
CP6382 HAS 15dB IF ATTEN

— is 290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 7.18dB at -3deg MIN: -32.43dB at 157deg  
..... MAX: -7.67dB at -9deg MIN: -31.06dB at 77deg

1. RPL01:19 MAY 92  
2. RPL01:19 MAY 92  
CP6382:28 OCT 91  
CP6382:28 OCT 91

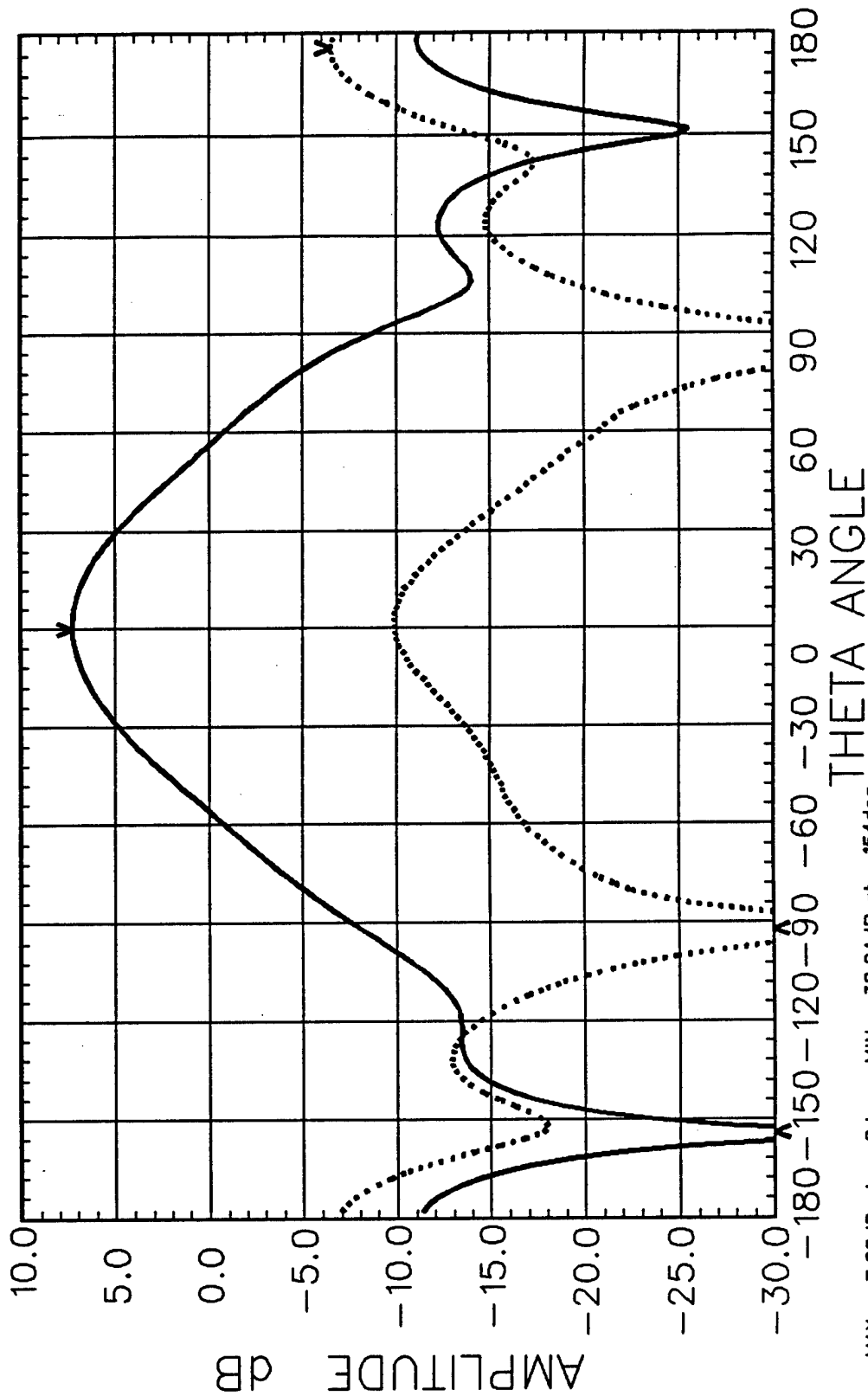
1/8"BELOW GP,5"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6383 HAS 15dB IF ATTEN  
CP6383 HAS 15dB IF ATTEN

320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



MAX: 7.26dB at 0deg MIN: -38.24dB at -154deg  
MAX: -6.49dB at 176deg MIN: -52.74dB at -92deg

1) REF: 19 MAY 92 CP6383-28 OCT 91  
2) REF: 19 MAY 92 CP6383-28 OCT 91

1/2"BELOW GP,1"BORDER  
18 NOV 92

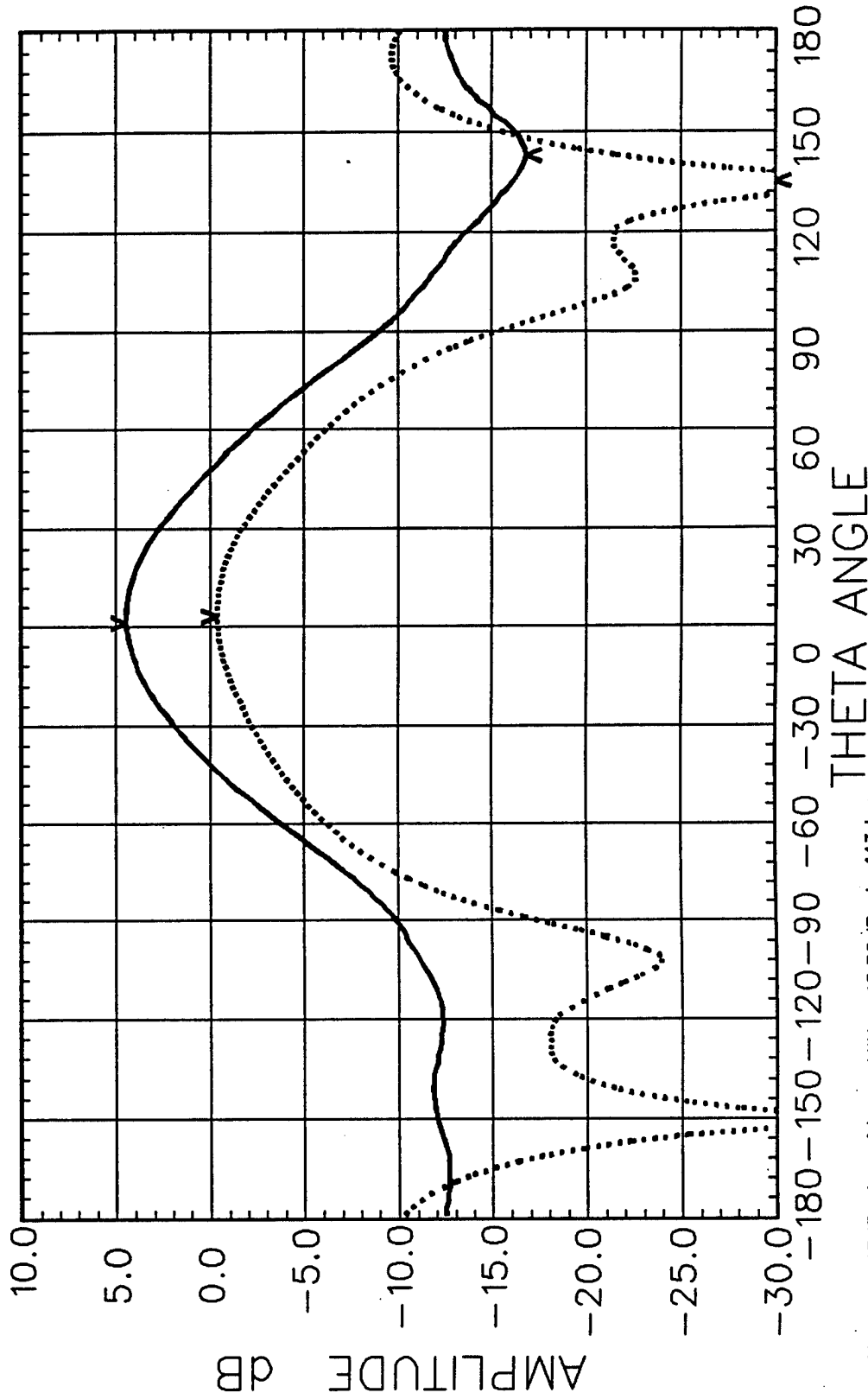
# TAGGANT

BALL AEROSPACE

CP6401 HAS 15dB IF ATTEN  
CP6401 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

260MHz RHCP GAIN PHI=  
260MHz LHCP GAIN PHI=



MAX: 4.45dB at 1deg MIN: -16.82dB at 143deg  
MAX: -37dB at 3deg MIN: -39.96dB at 135deg

2) RPLUT:18 MAY 92  
CP6401:28 OCT 91

1/2"BELOW GP,1"BORDER  
18 NOV 92

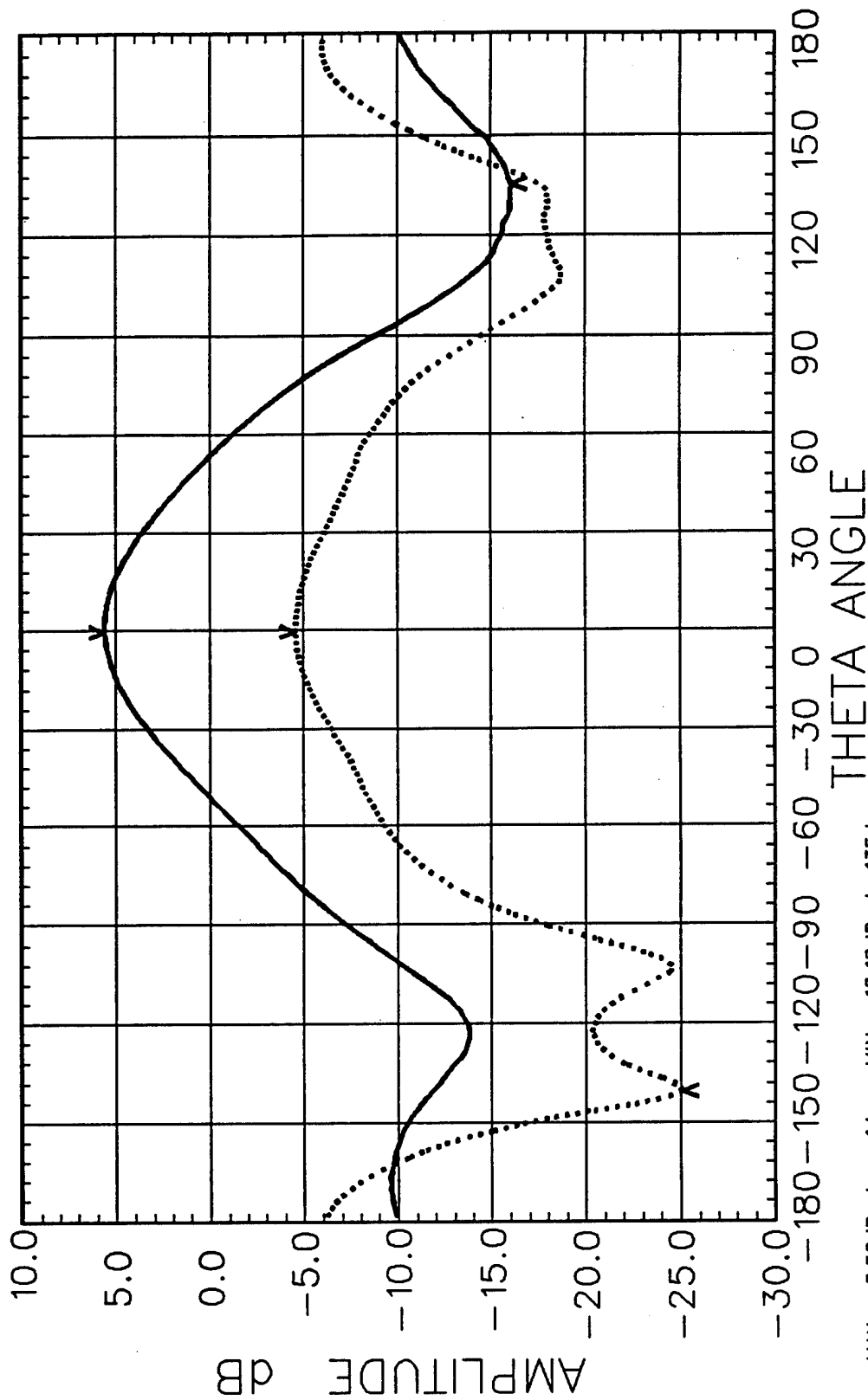
# TAGGANT

BALL AEROSPACE

CP6402 HAS 15dB IF ATTEN  
CP6402 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

290MHz RHCP GAIN PHI=  
290MHz LHCP GAIN PHI=



MAX: 5.59dB at -1deg MIN: -16.10dB at 135deg  
MAX: -4.56dB at -1deg MIN: -25.14dB at 141deg

18 NOV 92  
CP6402 HAS 15dB IF ATTEN  
CP6402 HAS 15dB IF ATTEN



1/2"BELOW GP,1"BORDER  
18 NOV 92

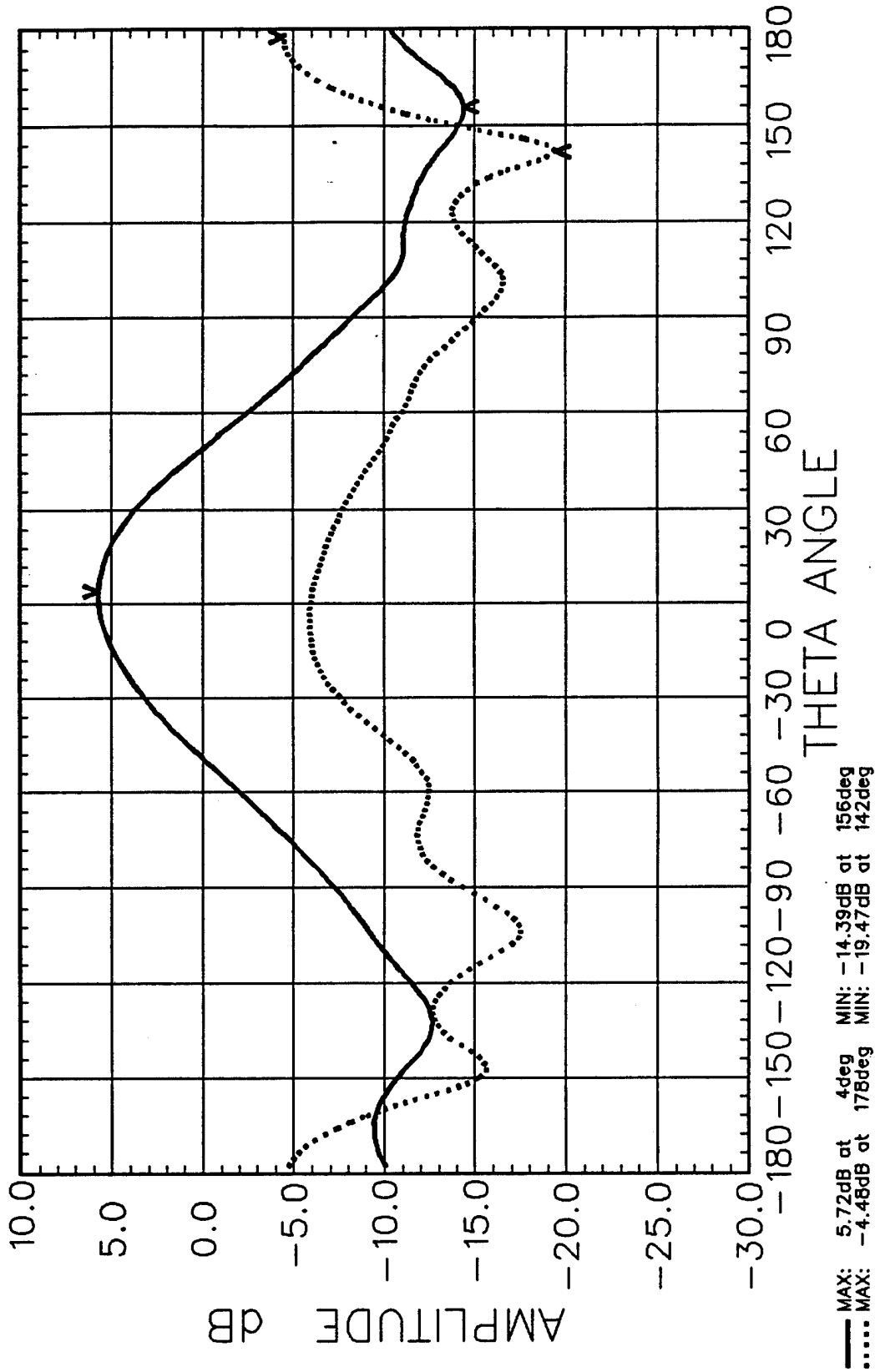
**TAGGANT**

BALL AEROSPACE

is 320MHz RHCP GAIN PHI=  
..... is 320MHz LHCP GAIN PHI=

CP6403 HAS 15dB IF ATTEN  
CP6403 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE



2) RFL07:19 MAY 92 CPXFM:28 OCT 91  
1) RFL07:19 MAY 92 CPXFM:28 OCT 91

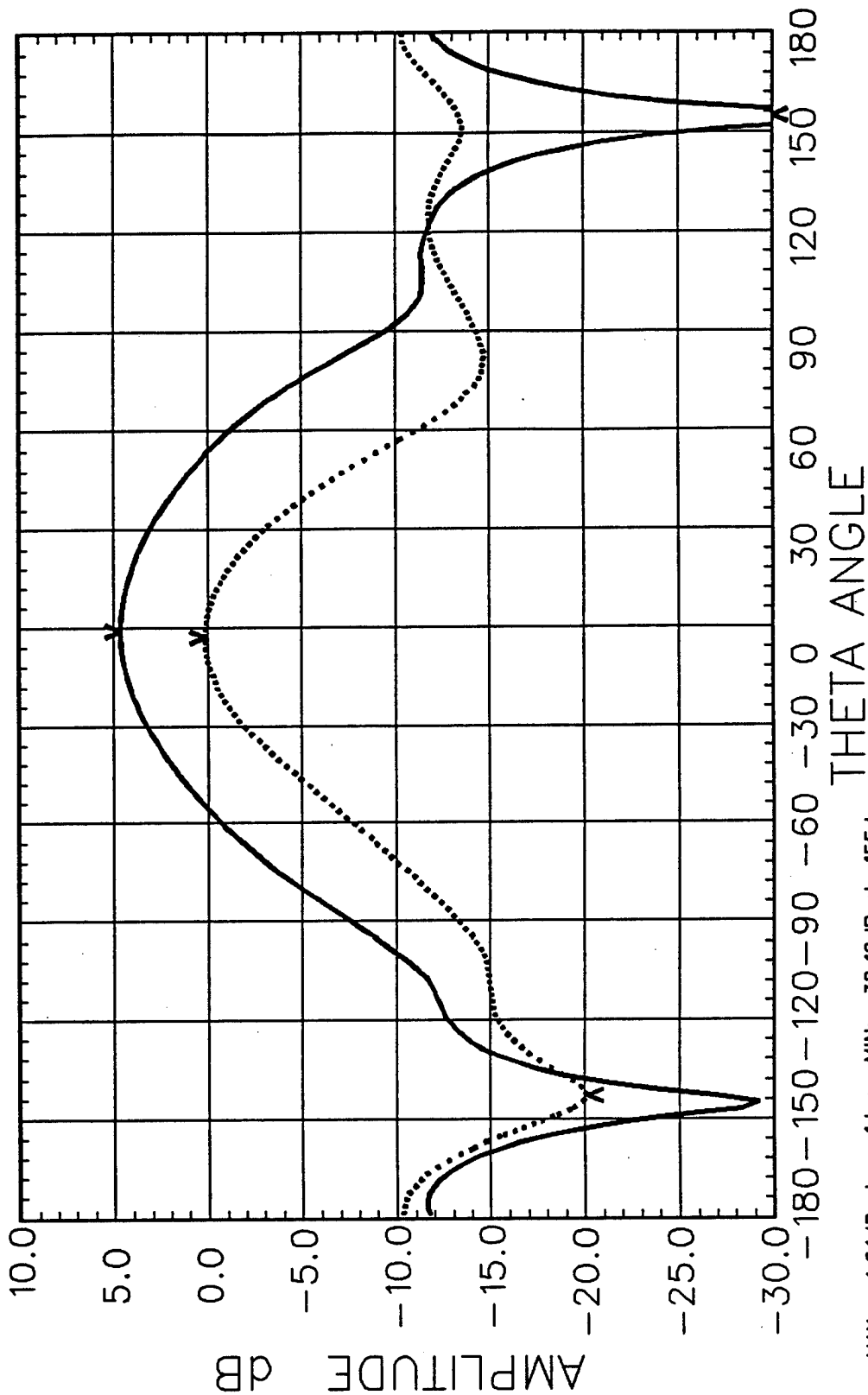
1/2"BELOW GP,1"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6421 HAS 15dB IF ATTEN  
CP6421 HAS 15dB IF ATTEN

— is 260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 4.64dB at -1deg MIN: -38.19dB at 155deg  
..... MAX: -12dB at -3deg MIN: -20.17dB at -143deg

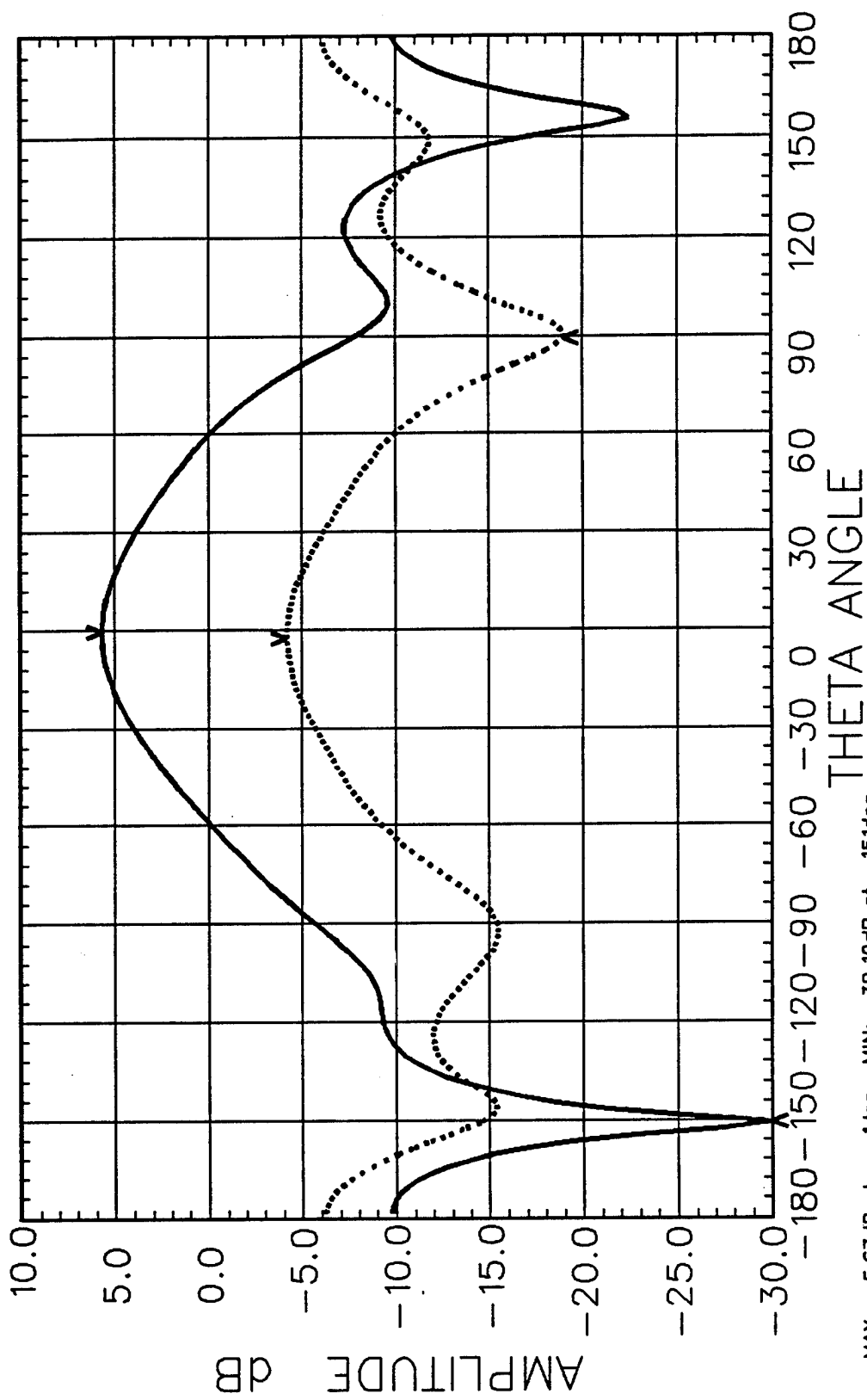
1/2"BELOW GP,1"BOARD  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6422 HAS 15dB IF ATTEN  
CP6422 HAS 15dB IF ATTEN

290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



MAX: 5.67dB at -1deg MIN: -30.19dB at -151deg  
MAX: -4.19dB at -3deg MIN: -18.98dB at 89deg

CP6422 HAS 15dB IF ATTEN  
CP6422 HAS 15dB IF ATTEN

1/2"BELOW GP,1"BORDER

**TAGGANT**

BALL AEROSPACE

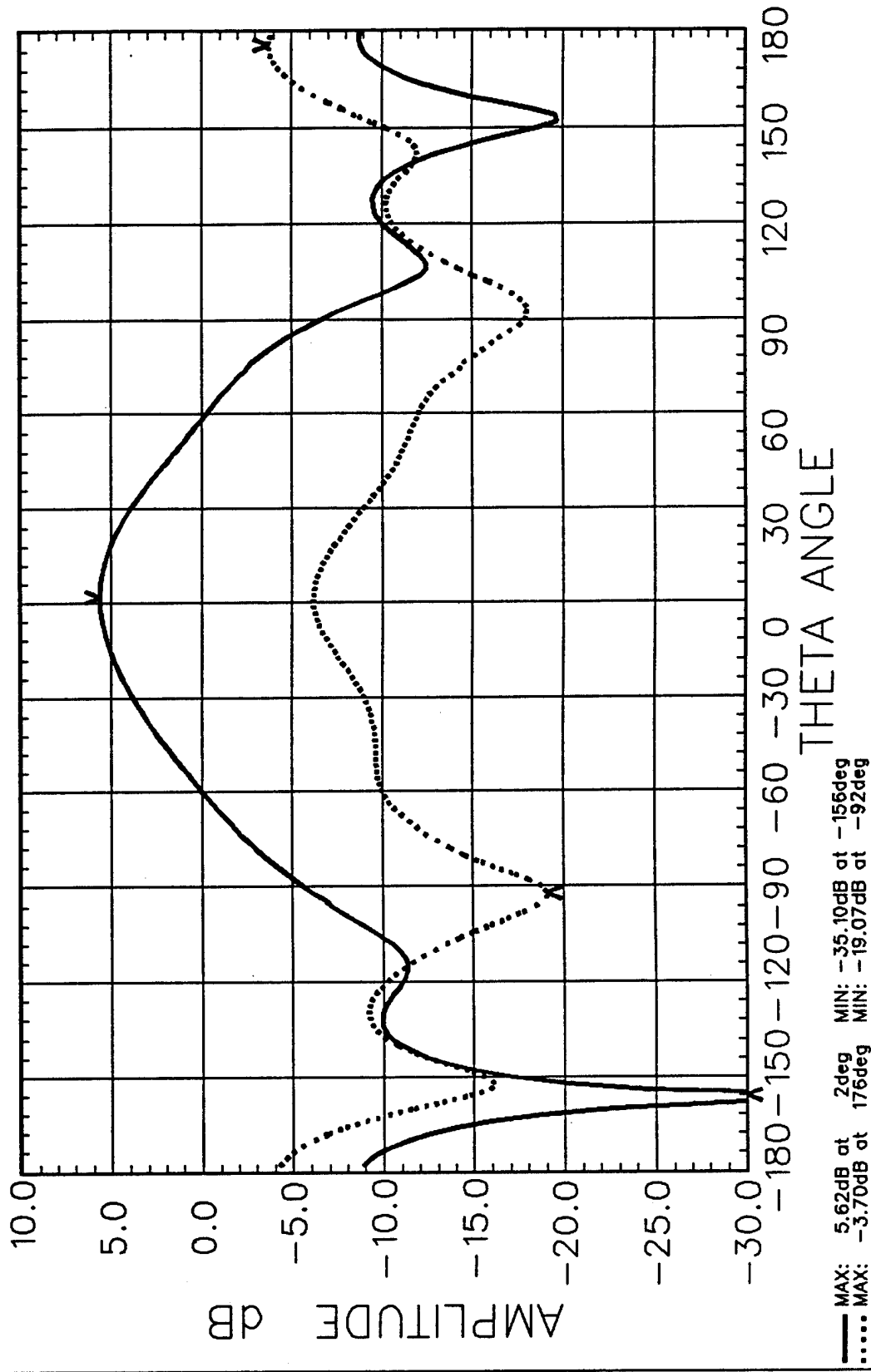
18 NOV 92

— is 320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

CP6423 HAS 15dB IF ATTEN

..... is 320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

CP6423 HAS 15dB IF ATTEN

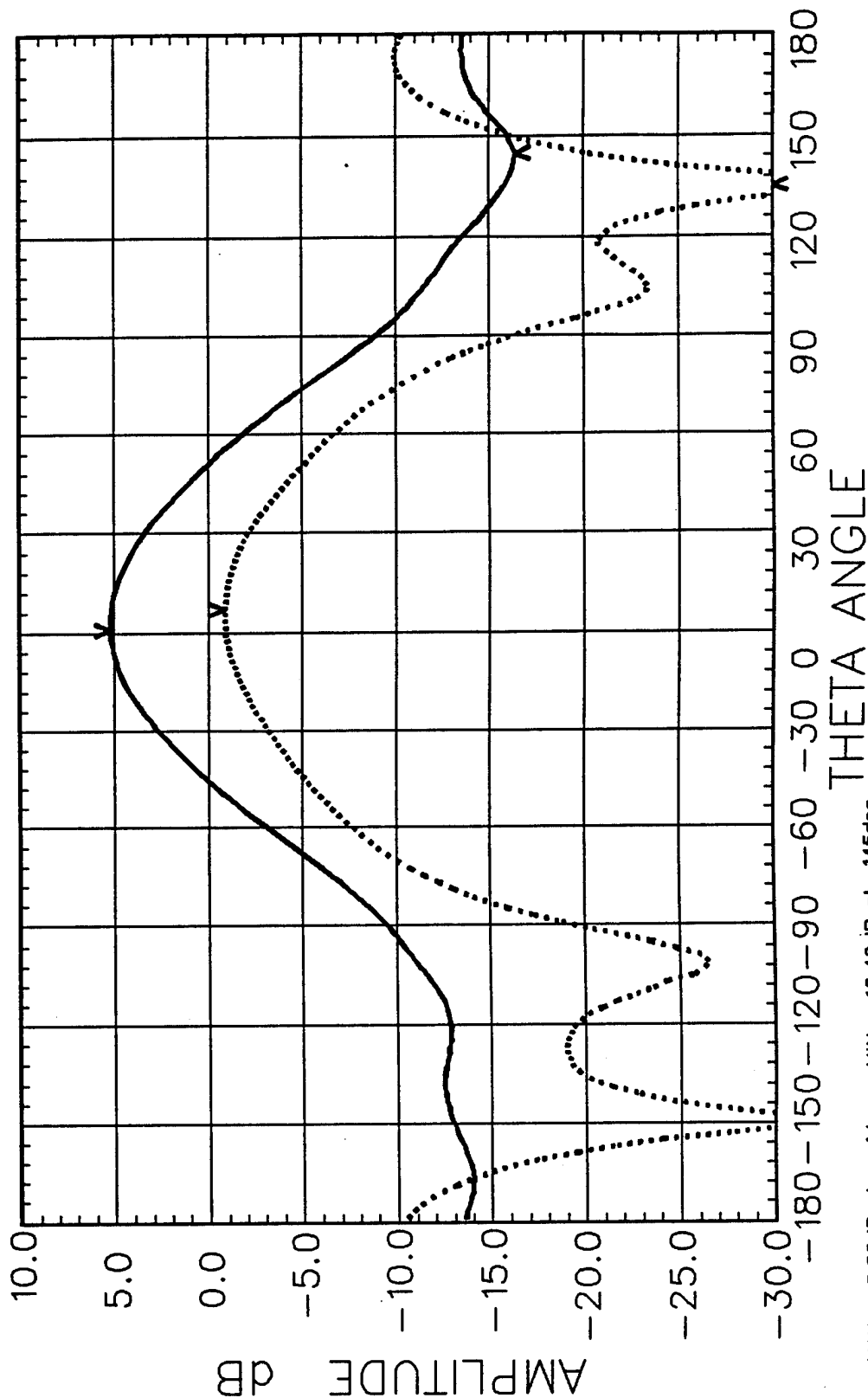


1) RFL07:19 MAY 92 CPXFM:28 OCT 91  
2) RFL07:19 MAY 92 CPXFM:28 OCT 91

CP6441 HAS 15dB IF ATTEN  
CP6441 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

is 260MHz RHCP GAIN PHI=  
is 260MHz LHCP GAIN PHI=



MAX: 5.22dB at 1deg MIN: -16.40dB at 145deg  
MAX: -1.88dB at 7deg MIN: -39.08dB at 135deg

1/2"BELOW GP,2"BORDER  
18 NOV 92

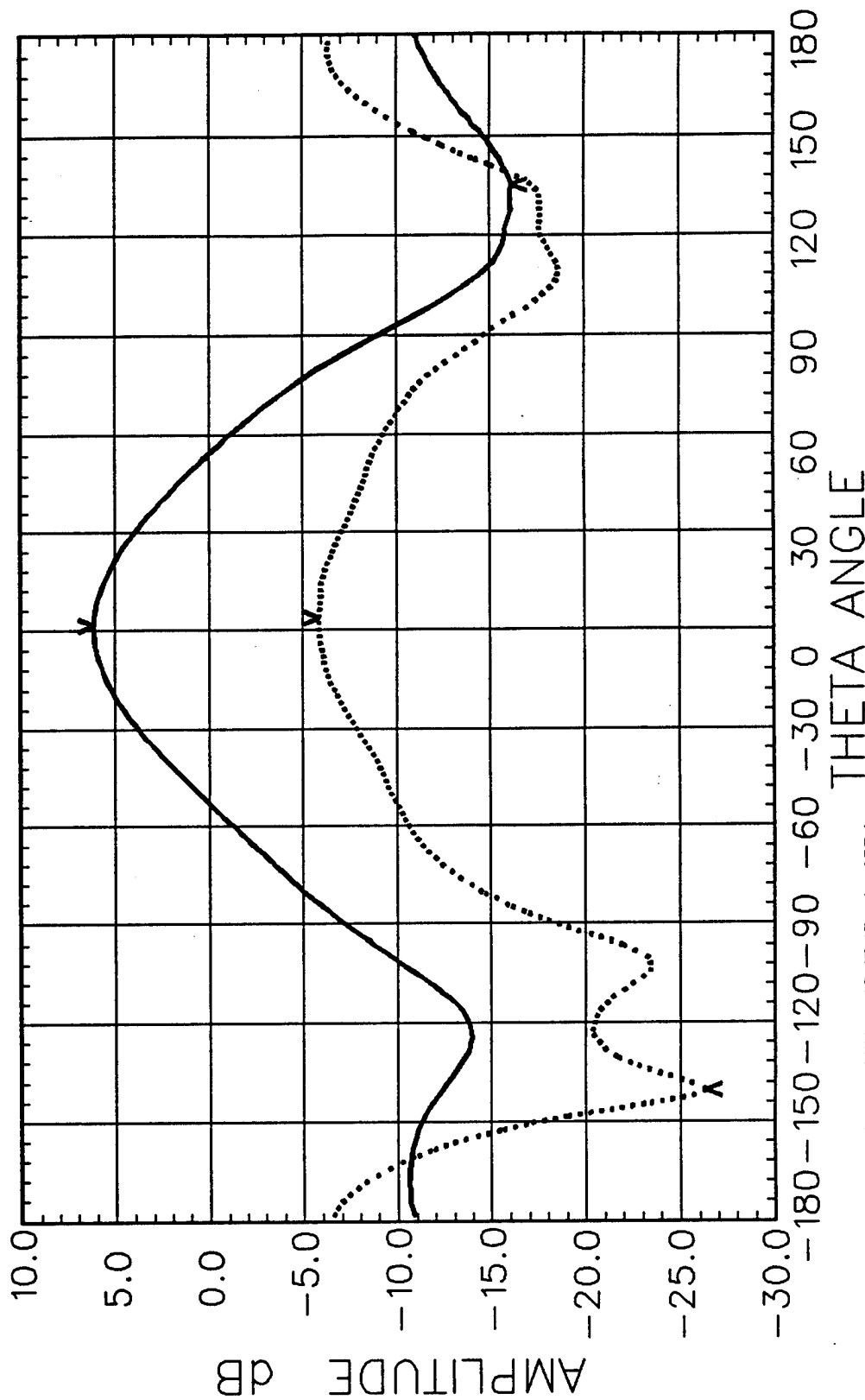
# TAGGANT

BALL AEROSPACE

CP6442 HAS 15dB IF ATTEN  
CP6442 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

is 290MHz RHCP GAIN PHI=  
is 290MHz LHCP GAIN PHI=



MAX: 6.12dB at 1deg MIN: -16.17dB at 135deg  
MAX: -5.85dB at 3deg MIN: -26.39dB at -141deg

18 NOV 92  
CP6442 HAS 15dB IF ATTEN  
CP6442 HAS 15dB IF ATTEN

1/2"BELOW GP,2"BORDER  
18 NOV 92

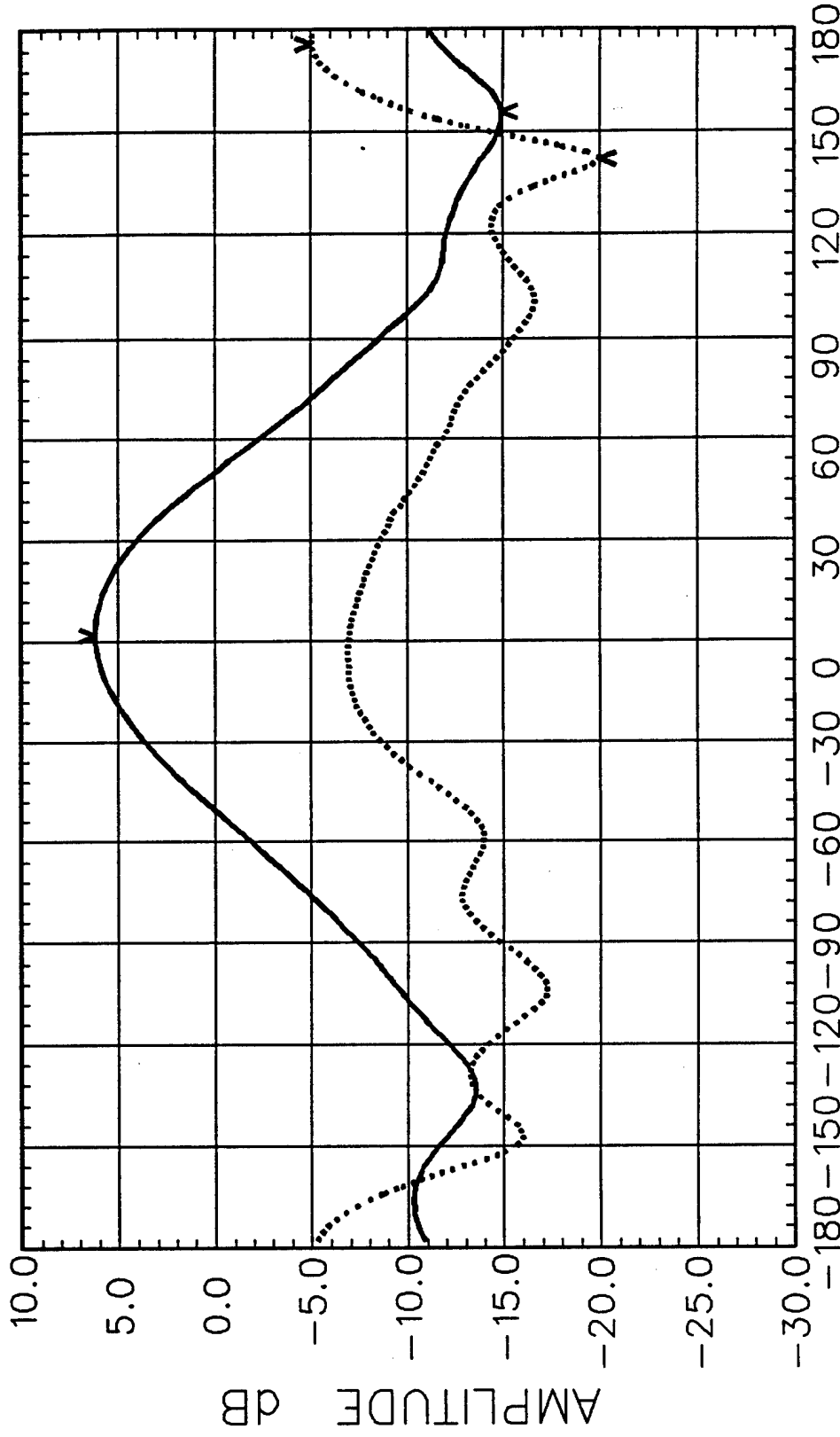
# TAGGANT

BALL AEROSPACE

CP6443 HAS 15dB IF ATTEN  
CP6443 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

320MHz RHCP GAIN PHI=  
320MHz LHCP GAIN PHI=



THETA ANGLE

MAX: 6.17dB at 2deg MIN: -14.91dB at 156deg  
MAX: -5.04dB at 176deg MIN: -20.03dB at 142deg

1) RPLDT:18 MAY 92 CP17M:28 OCT 91  
2) RPLDT:18 MAY 92 CP17M:28 OCT 91

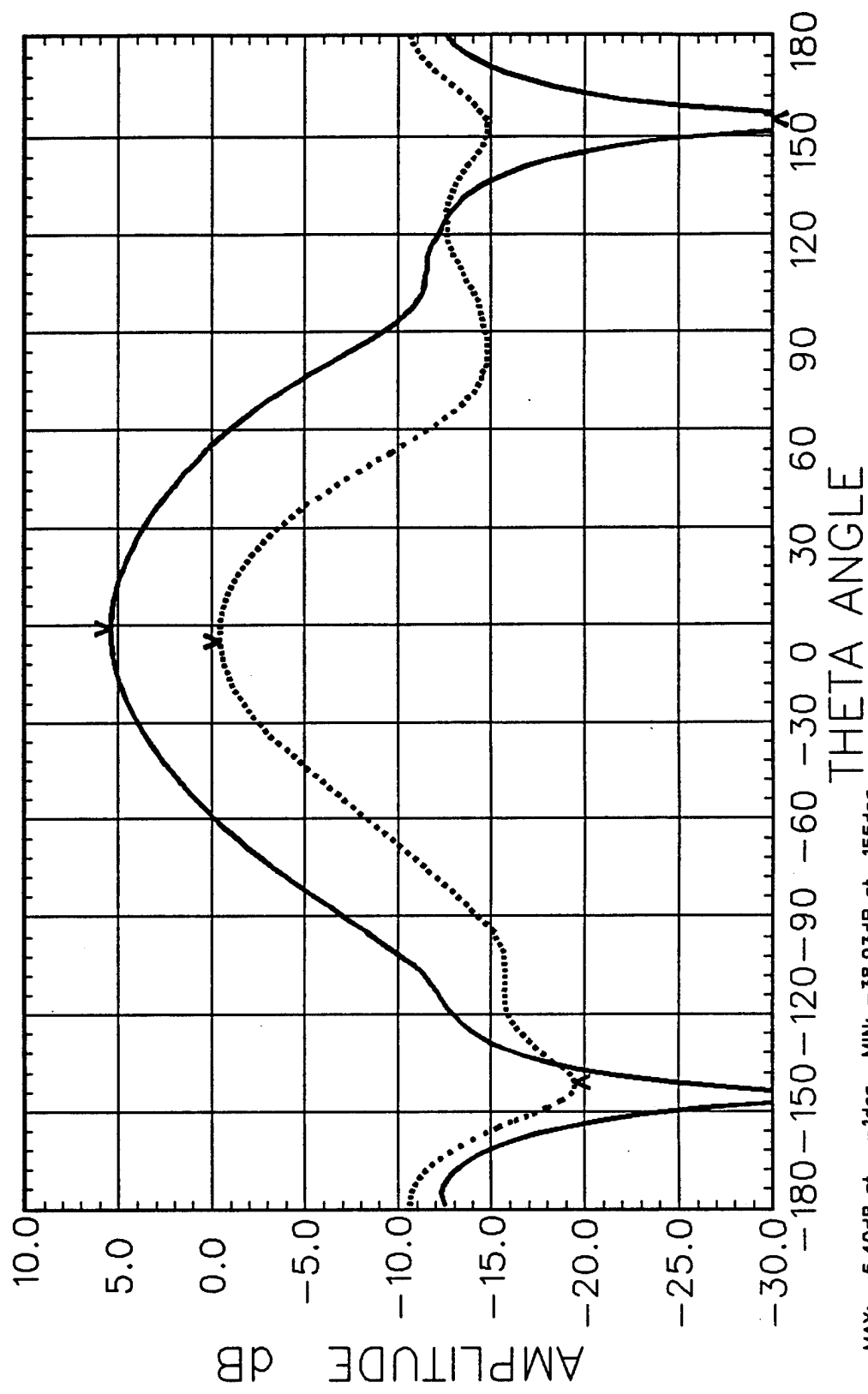
1/2"BELOW GP,2"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6461 HAS 15dB IF ATTEN  
CP6461 HAS 15dB IF ATTEN

is 260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



MAX: 5.40dB at -1deg MIN: -38.93dB at 155deg  
..... MAX: -4.5dB at -5deg MIN: -19.49dB at -141deg

2) RPL01:19 MAY 92  
CP6461:28 OCT 91  
CP6461:28 OCT 91



1/2"BELOW GP,2"BORDER  
18 NOV 92

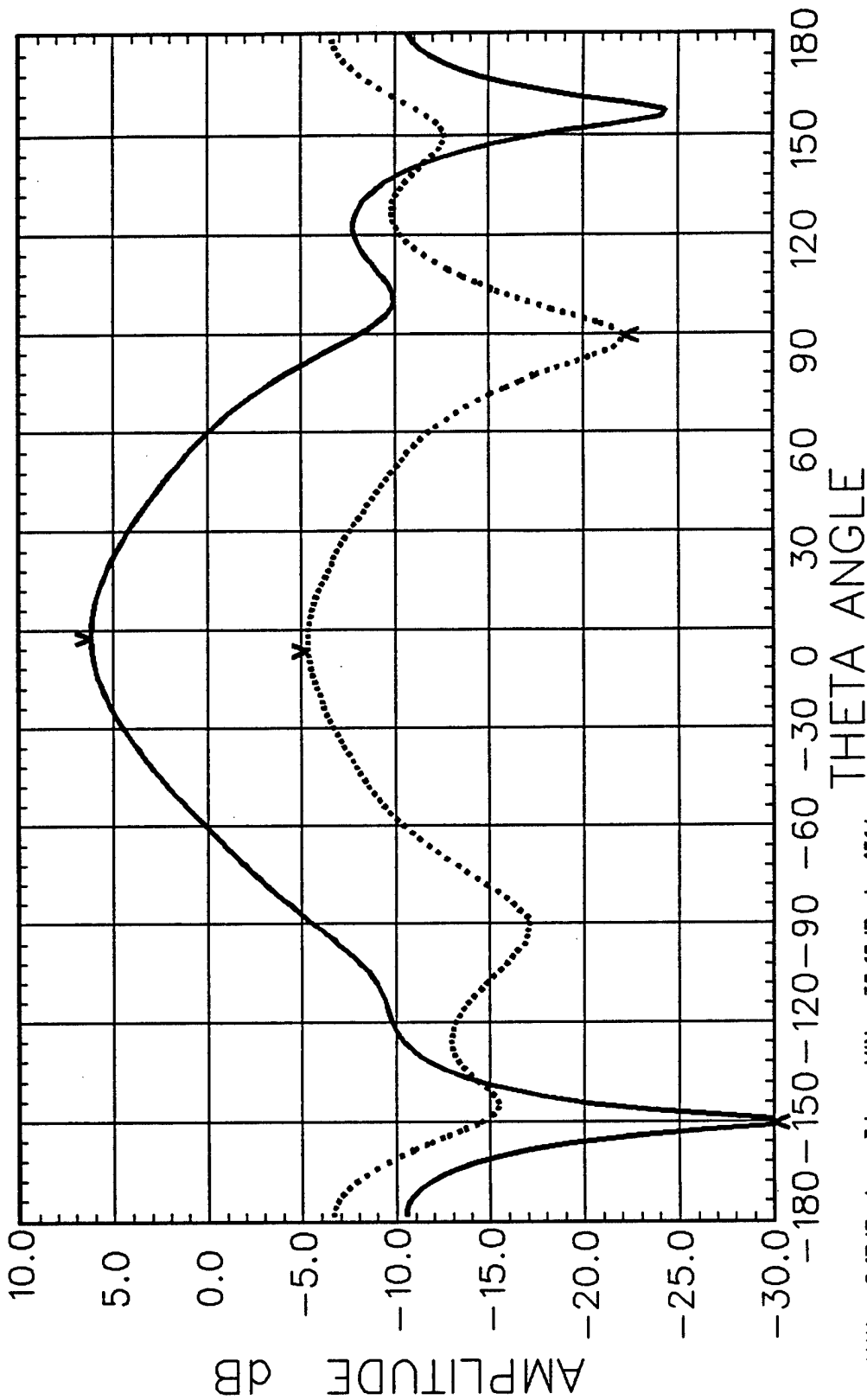
**TAGGANT**

BALL AEROSPACE

CP6462 HAS 15dB IF ATTEN  
CP6462 HAS 15dB IF ATTEN

290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

is  
..... is



MAX: 6.17dB at -3deg MIN: -32.16dB at -151deg  
MAX: -5.33dB at -7deg MIN: -22.13dB at 89deg

2) RPLUT: 18 MAY 92  
CP6462: 28 OCT 91

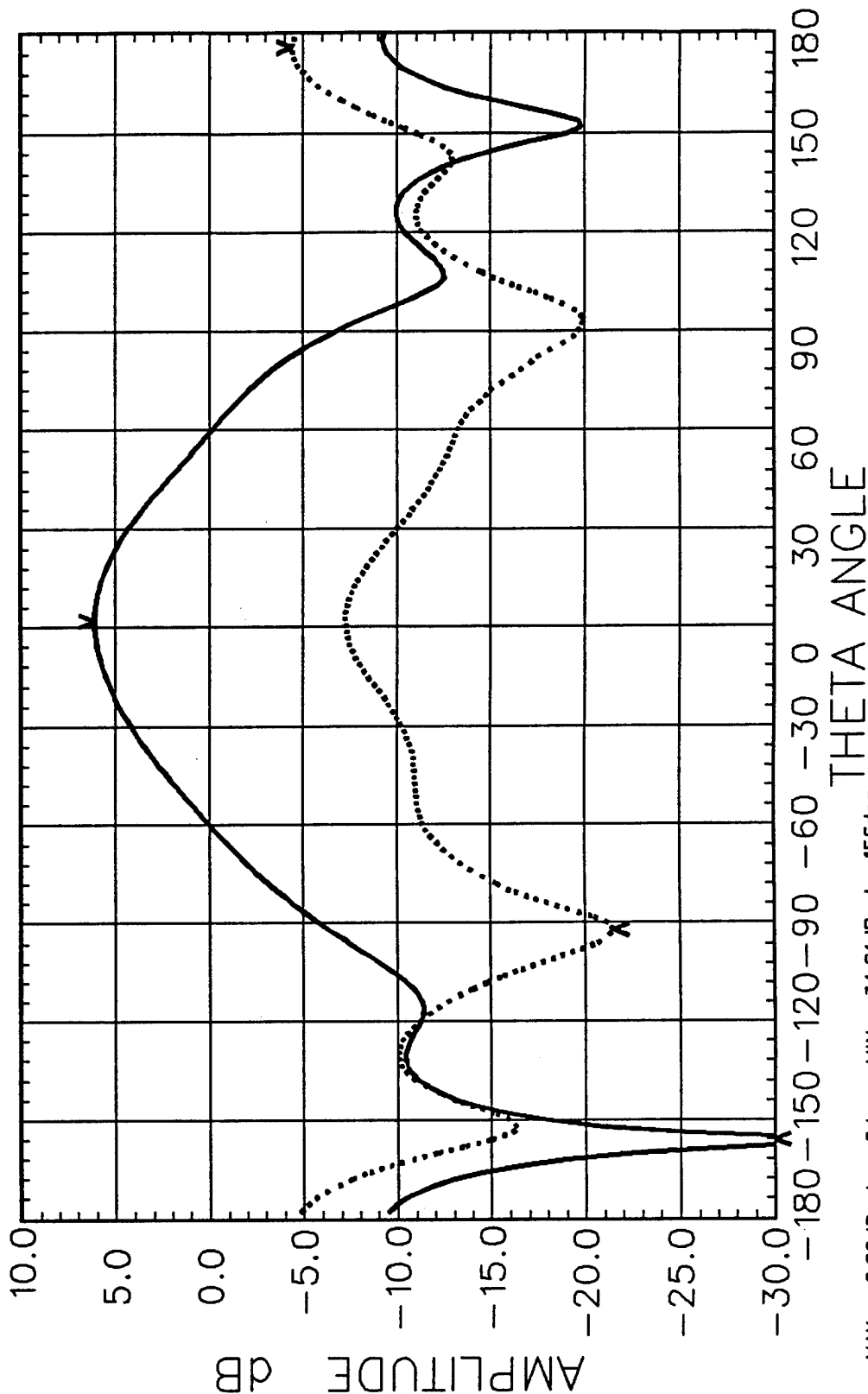
1/2"BELOW GP,2"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6463 HAS 15dB IF ATEN  
CP6463 HAS 15dB IF ATEN

— is 320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
..... is 320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 6.09dB at 2deg MIN: -34.61dB at -156deg  
..... MAX: -4.41dB at 176deg MIN: -21.51dB at -92deg

2) REF: 18 MAY 92  
CP6463 28 OCT 91  
CP6463 28 OCT 91

1/2"BELOW GP,3"BORDER  
18 NOV 92

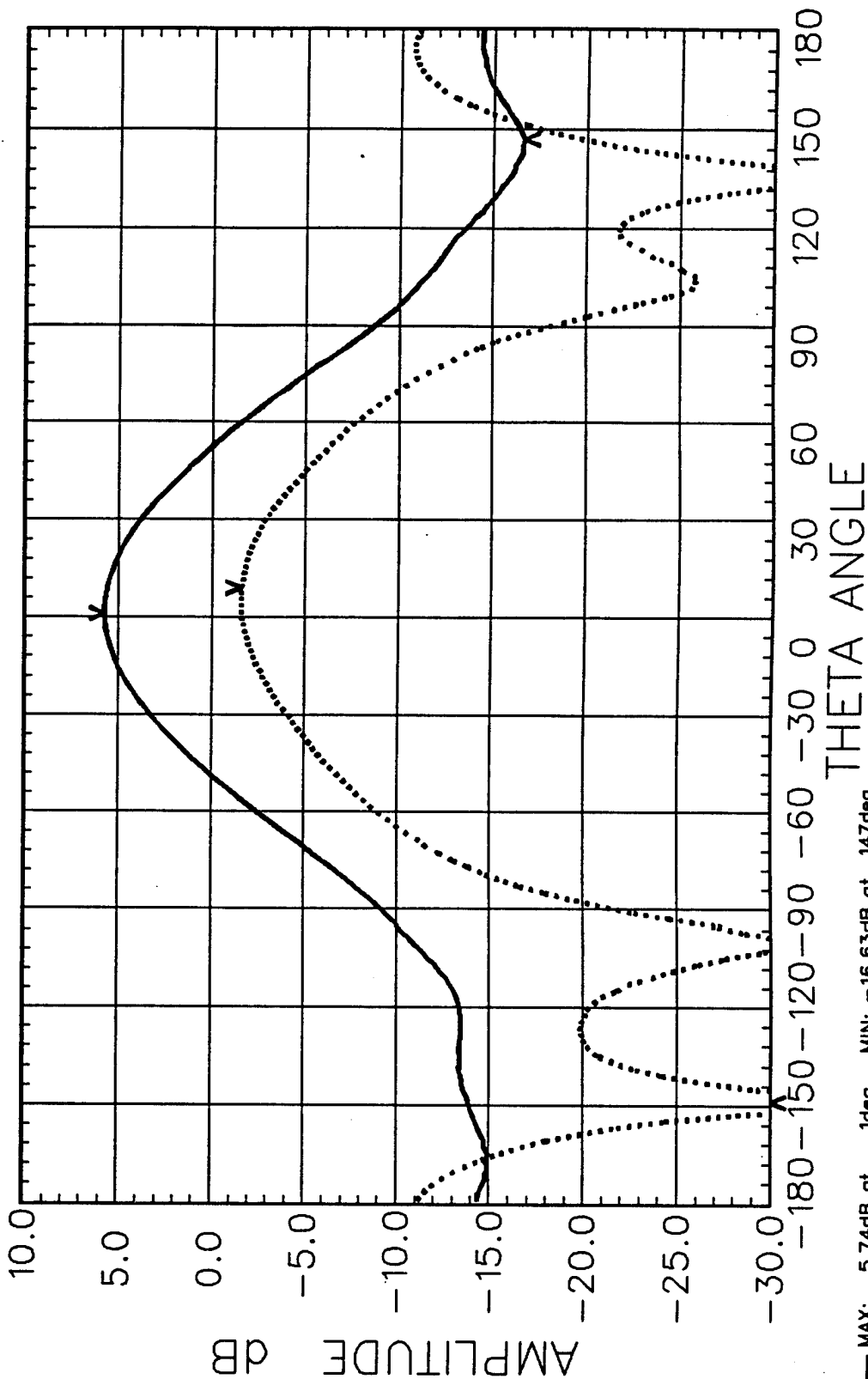
# TAGGANT

BALL AEROSPACE

CP6481 HAS 15dB IF ATTEN  
CP6481 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

260MHz RHCP GAIN PHI=  
260MHz LHCP GAIN PHI=



MAX: 5.74dB at 1deg MIN: -16.63dB at 147deg  
MAX: -1.57dB at 9deg MIN: -38.71dB at -149deg

1) RFLUT:18 MAY 92 CP6481:28 OCT 91  
2) RFLUT:18 MAY 92 CP6481:28 OCT 91

1/2"BELOW GP,3"BORDER  
18 NOV 92

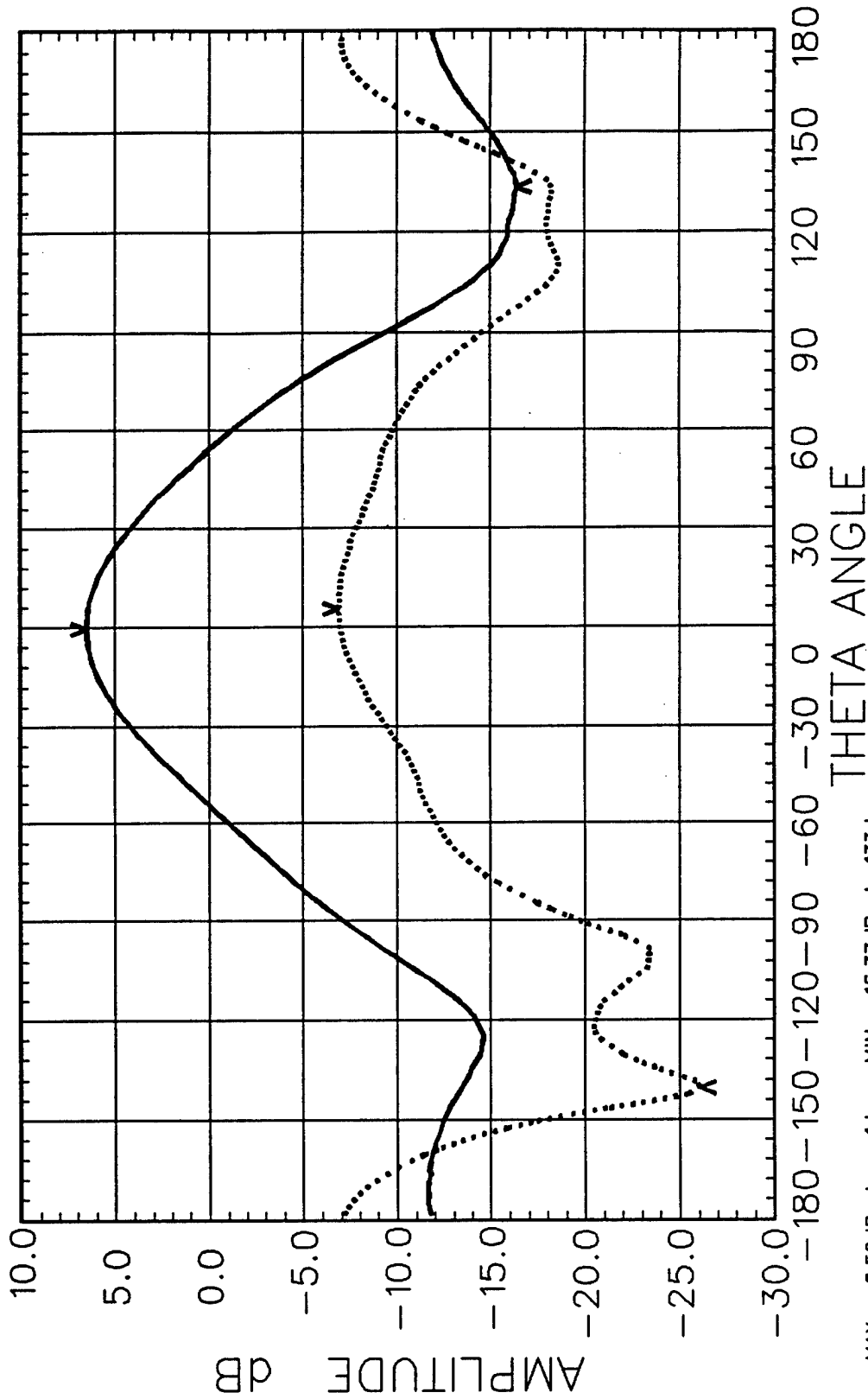
# TAGGANT

BALL AEROSPACE

CP6482 HAS 15dB IF ATTEN  
CP6482 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

is 290MHz RHCP GAIN PHI=  
is 290MHz LHCP GAIN PHI=



MAX: 6.50dB at -1deg MIN: -16.37dB at 133deg  
MAX: -6.89dB at 5deg MIN: -26.11dB at -141deg

2) RELOT:18 MAY 92  
CP15M:28 OCT 91  
CP15M:28 OCT 91  
CP15M:28 OCT 91

1/2"BELOW GP,3"BORDER  
18 NOV 92

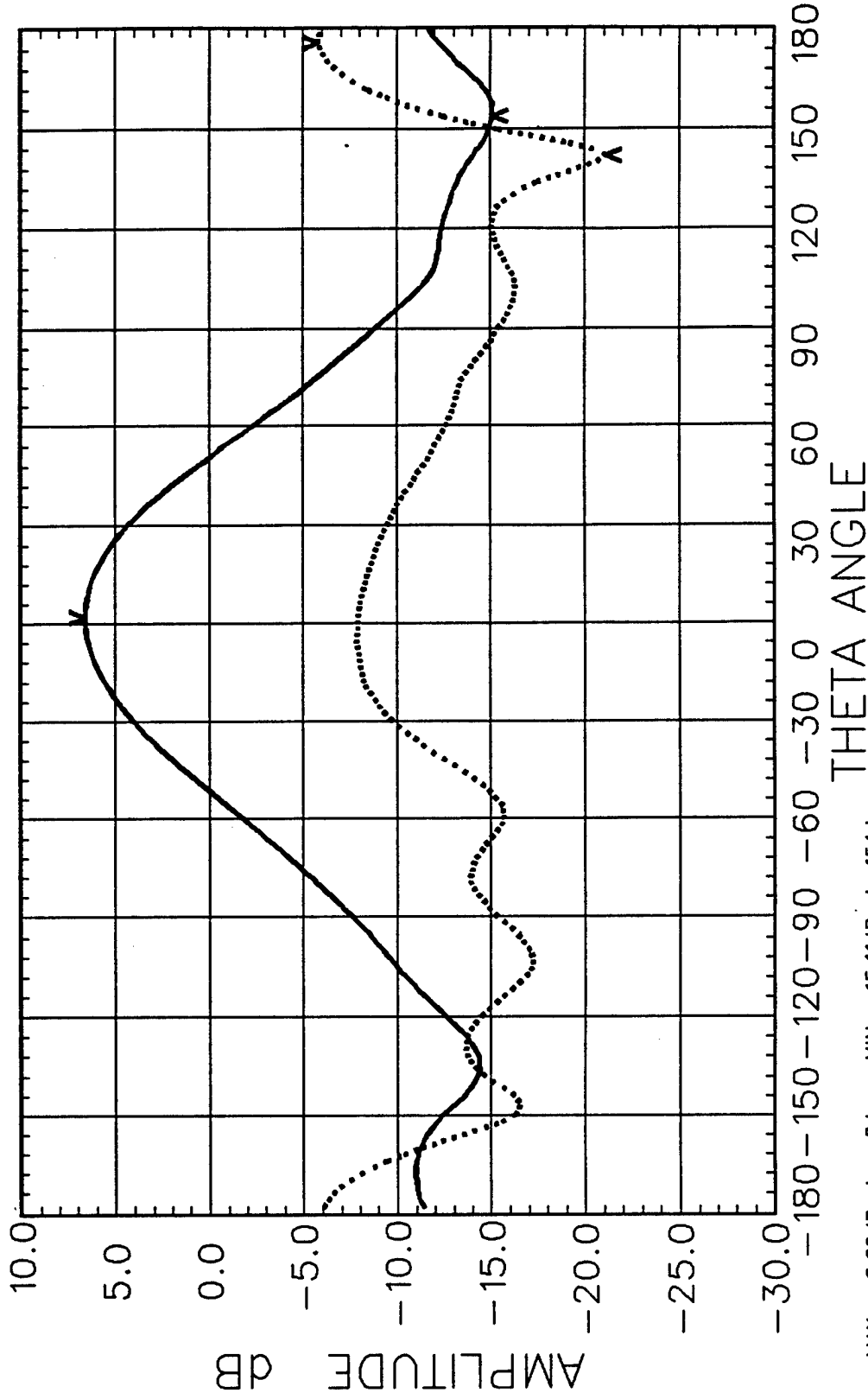
**TAGGANT**

BALL AEROSPACE

CP6483 HAS 15dB IF ATTEN  
CP6483 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

320MHz RHCP GAIN PHI=  
320MHz LHCP GAIN PHI=



MAX: 6.60dB at 2deg MIN: -15.11dB at 154deg  
MAX: -5.82dB at 176deg MIN: -21.15dB at 142deg

1) RPLT:18 MAY 92  
2) RPLT:18 MAY 92  
CP6483 HAS 15dB IF ATTEN  
CP6483 HAS 15dB IF ATTEN

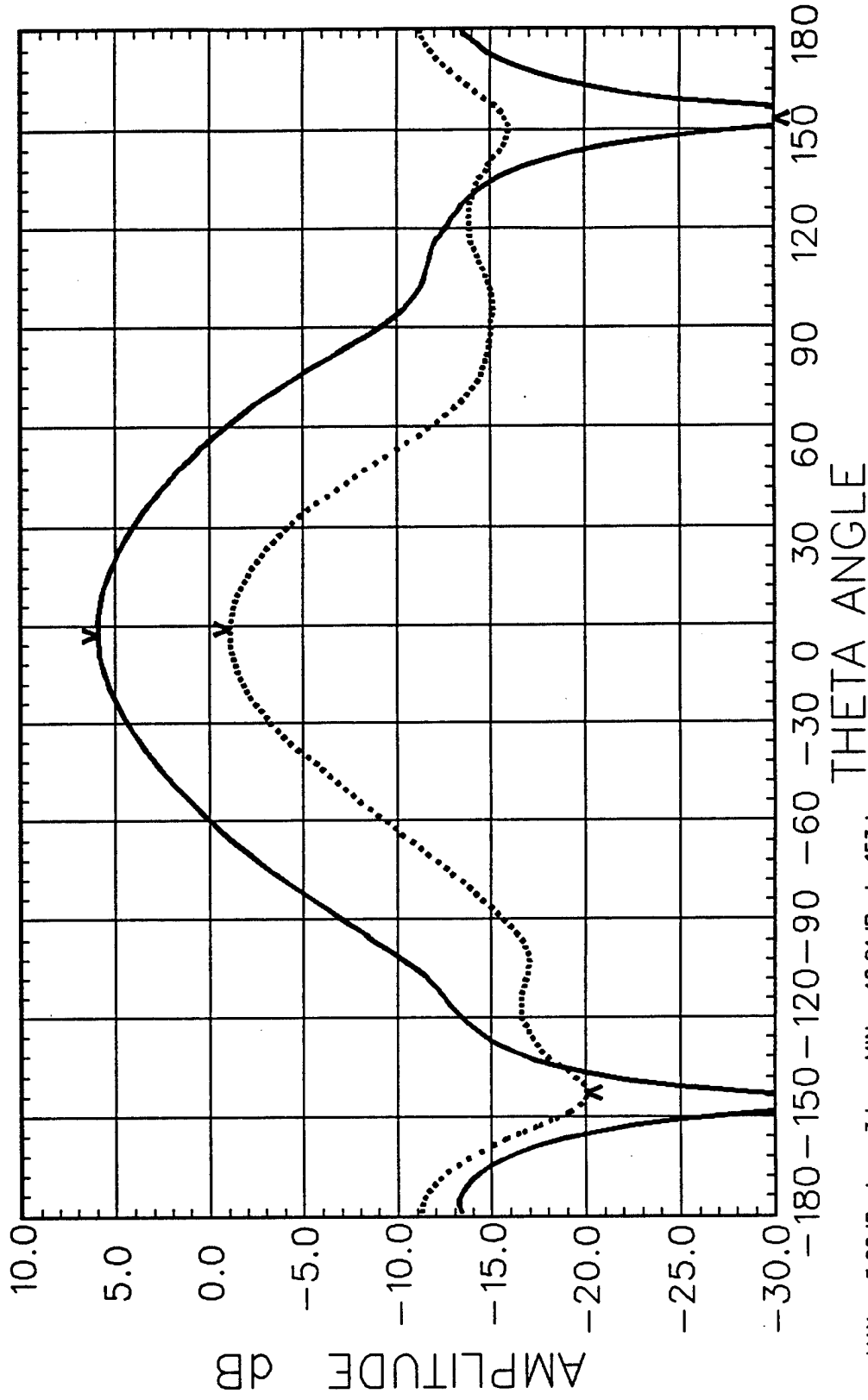
1/2"BELOW GP,3"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6501 HAS 15dB IF ATTEN  
CP6501 HAS 15dB IF ATTEN

260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



MAX: 5.92dB at -3deg MIN: -42.01dB at 153deg  
MAX: -1.09dB at -1deg MIN: -20.05dB at -143deg

1) RPLD:19 MAY 92  
2) RPLD:19 MAY 92  
CP6501:28 OCT 91  
CP6501:28 OCT 91

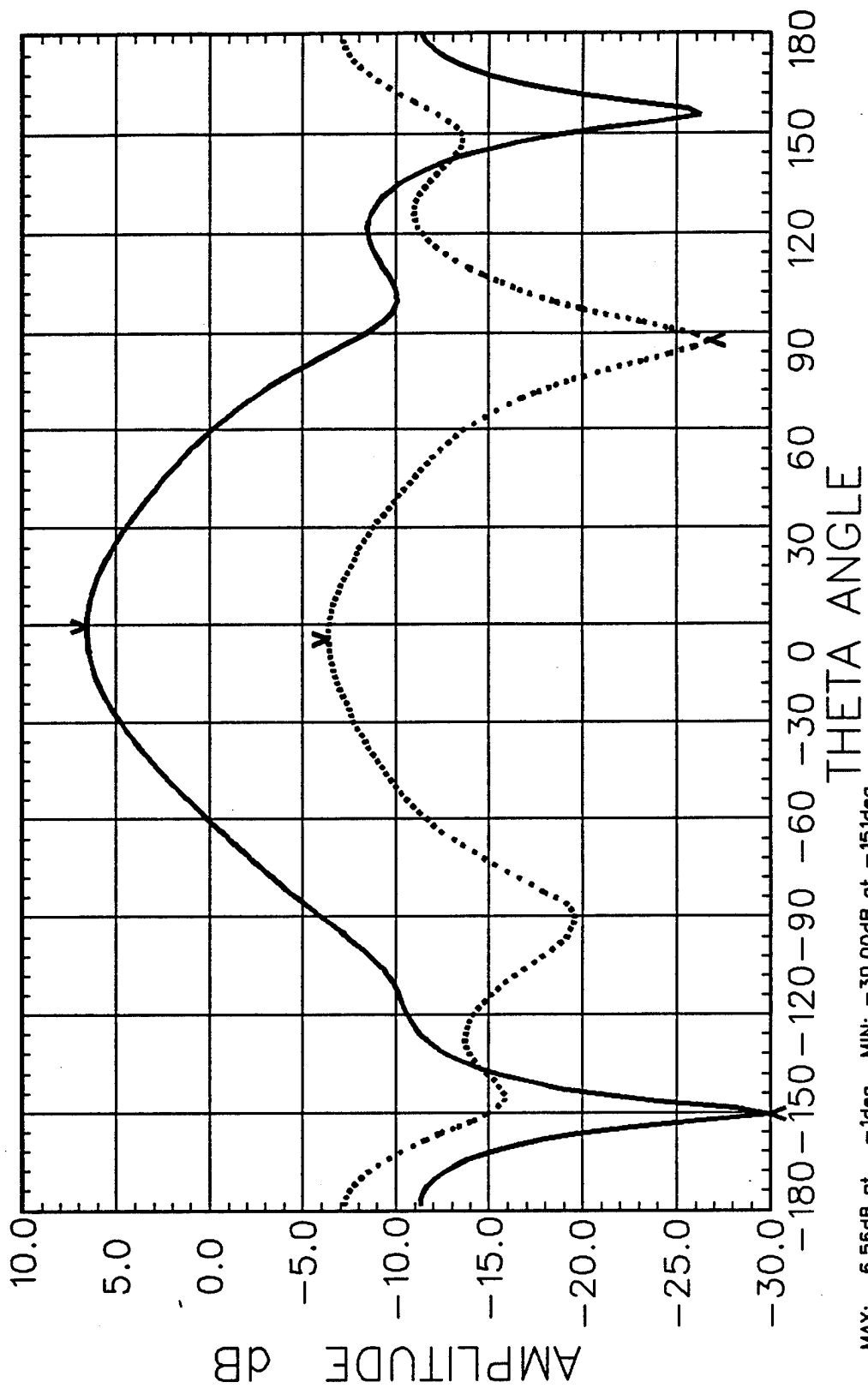
1/2"BELOW GP,3"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6502 HAS 15dB IF ATTEN  
CP6502 HAS 15dB IF ATTEN

290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



MAX: 6.56dB at -1deg MIN: -30.00dB at -151deg  
MAX: -6.37dB at -5deg MIN: -26.80dB at 87deg

1) REPT: 18 MAY 92  
2) REPT: 19 MAY 92  
CPXEM: 28 OCT 81

1/2"BELOW GP,3"BORDER  
18 NOV 92

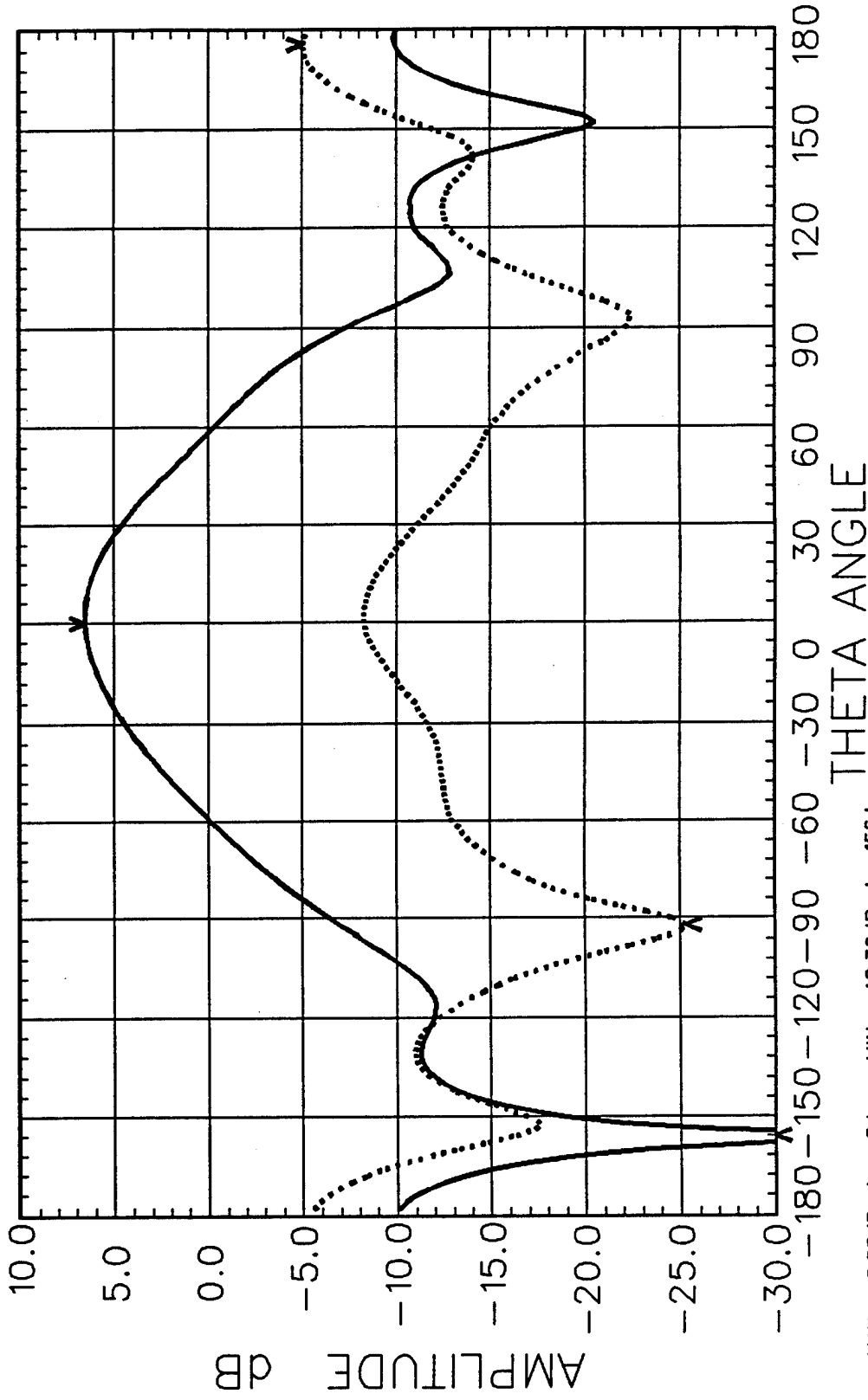
# TAGGANT

BALL AEROSPACE

CP6503 HAS 15dB IF ATTEN  
CP6503 HAS 15dB IF ATTEN

320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

— is  
..... is



— MAX: 6.53dB at 0deg MIN: -40.39dB at -156deg  
..... MAX: -5.04dB at 176deg MIN: -25.32dB at -92deg



1/2"BELOW GP,5"BORDER  
18 NOV 92

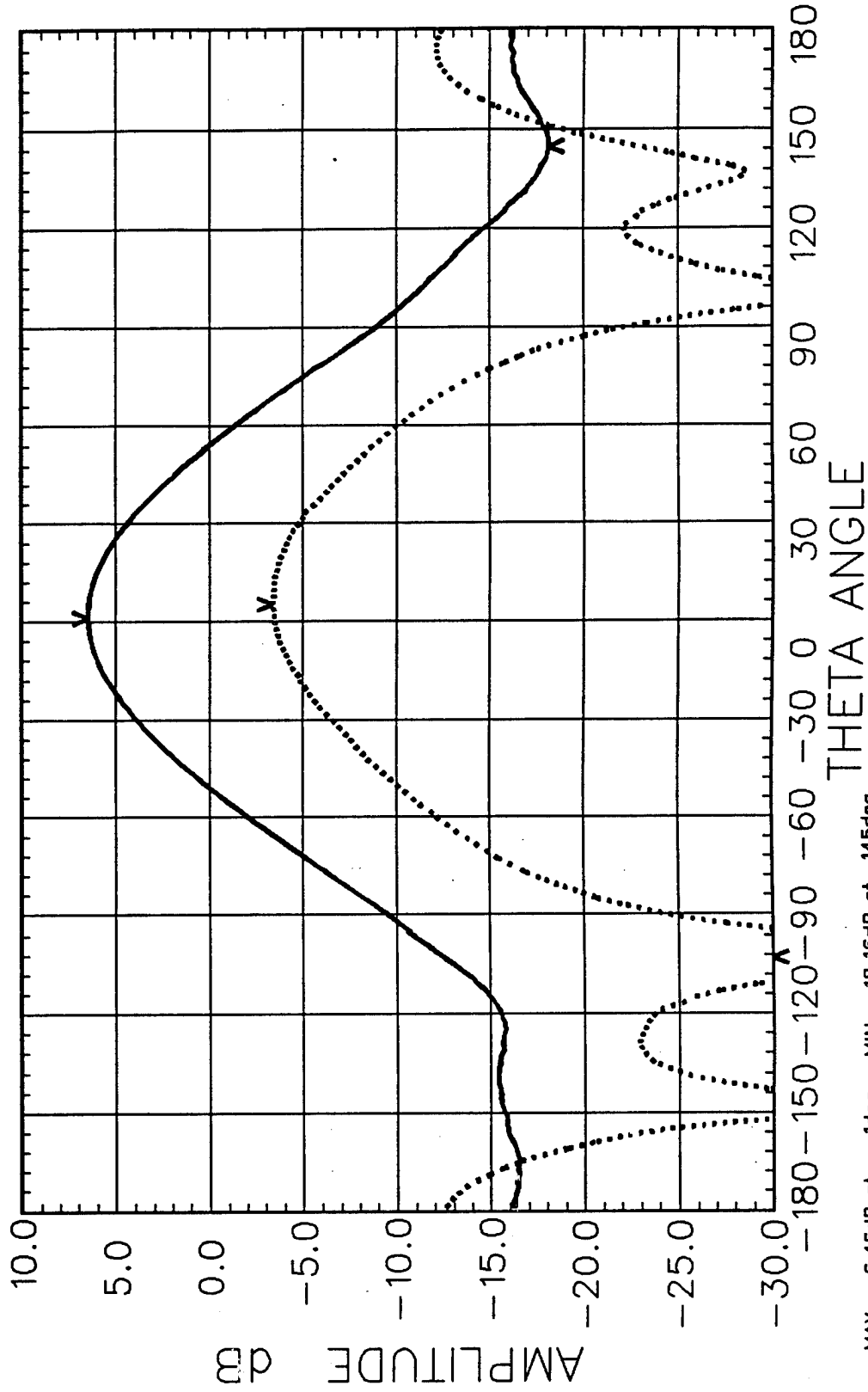
# TAGGANT

BALL AEROSPACE

CP6521 HAS 15dB IF ATTEN  
CP6521 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

260MHz RHCP GAIN PHI=  
260MHz LHCP GAIN PHI=



MAX: 6.45dB at 1deg MIN: -18.16dB at 145deg  
MAX: -3.39dB at 5deg MIN: -52.19dB at -103deg

2) RPLD:19 MAY 92  
CP6521:28 OCT 91  
CP6521:28 OCT 91

1/2"BELOW GP,5"BORDER  
18 NOV 92

# TAGGANT

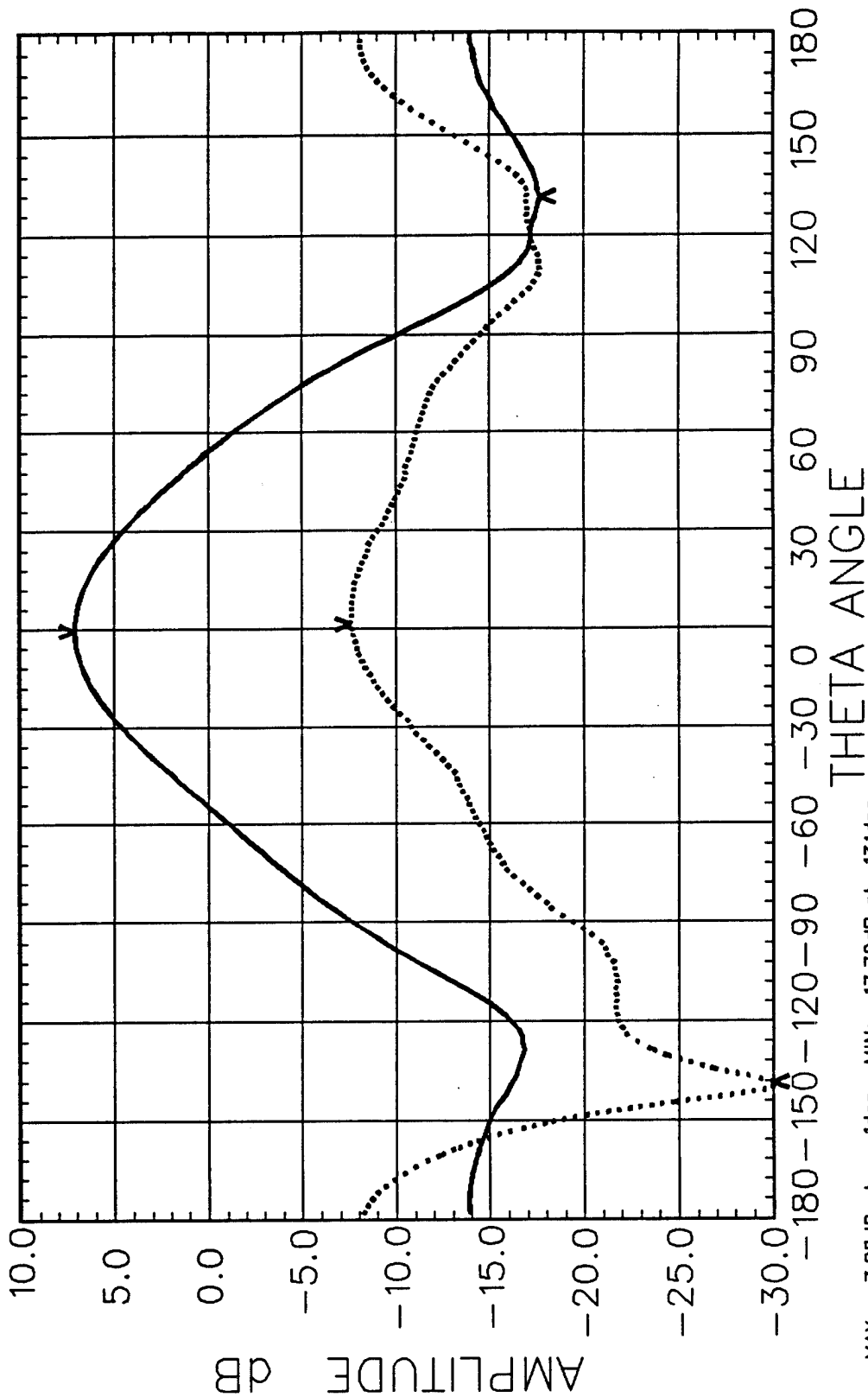
BALL AEROSPACE

CP6522 HAS 15dB IF ATTEN  
CP6522 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

290MHz RHCP GAIN PHI=  
290MHz LHCP GAIN PHI=

is  
is



MAX: 7.08dB at -1deg MIN: -17.70dB at 131deg  
MAX: -7.60dB at 1deg MIN: -30.04dB at -139deg

1) RPLDT:19 MAY 92  
CPXFM:28 OCT 91  
2) RPLDT:19 MAY 92  
CPXFM:28 OCT 91

1/2"BELOW GP,5"BORDER  
18 NOV 92

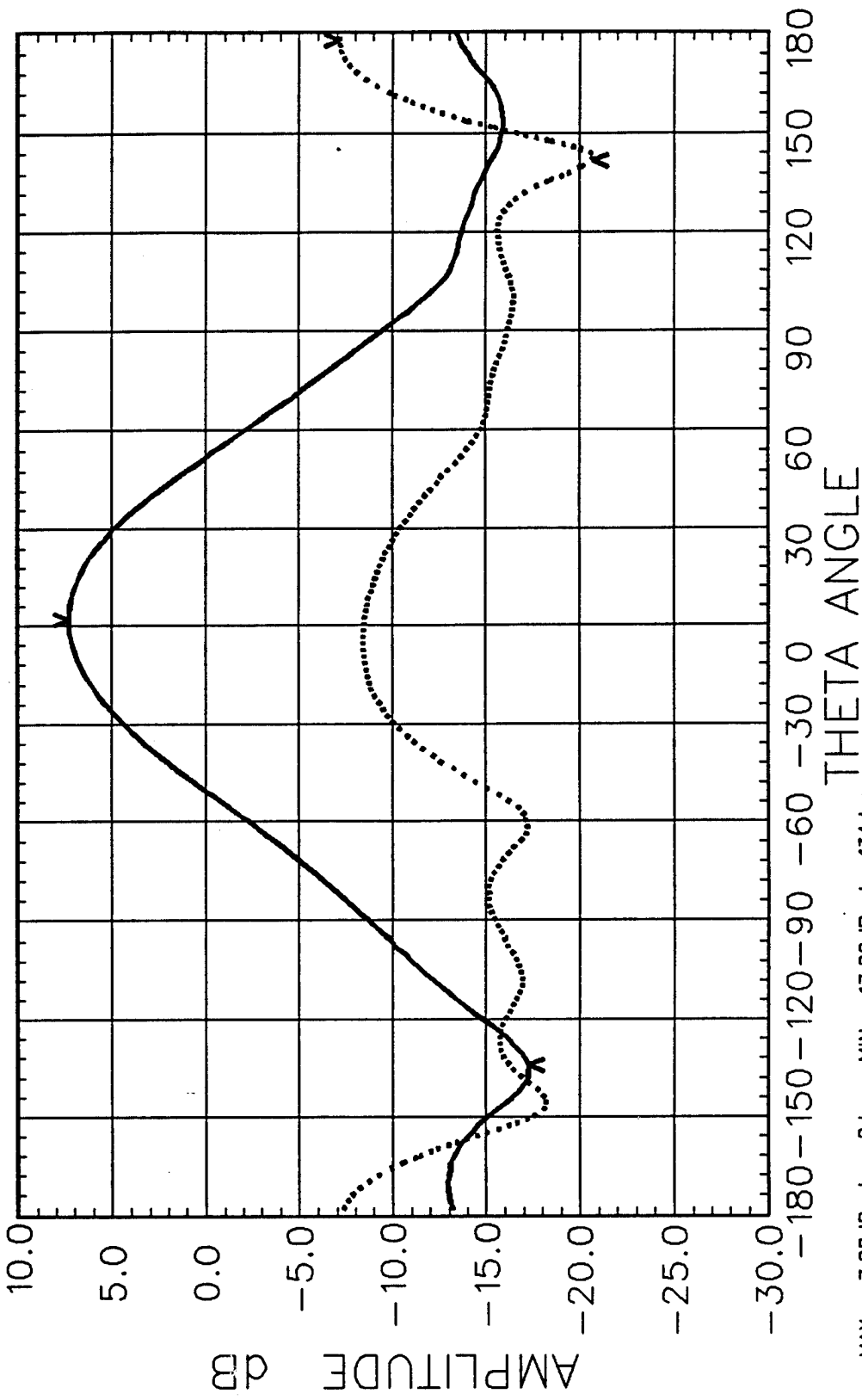
# TAGGANT

BALL AEROSPACE

CP6523 HAS 15dB IF ATTEN  
CP6523 HAS 15dB IF ATTEN

0deg ABSOLUTE AMPLITUDE  
0deg ABSOLUTE AMPLITUDE

is 320MHz RHCP GAIN PHI=  
is 320MHz LHCP GAIN PHI=



MAX: 7.28dB at 2deg MIN: -17.29dB at -134deg  
MAX: -7.16dB at 178deg MIN: -20.72dB at 142deg

1) RPL01:19 MAY 92  
2) RPL01:28 OCT 91

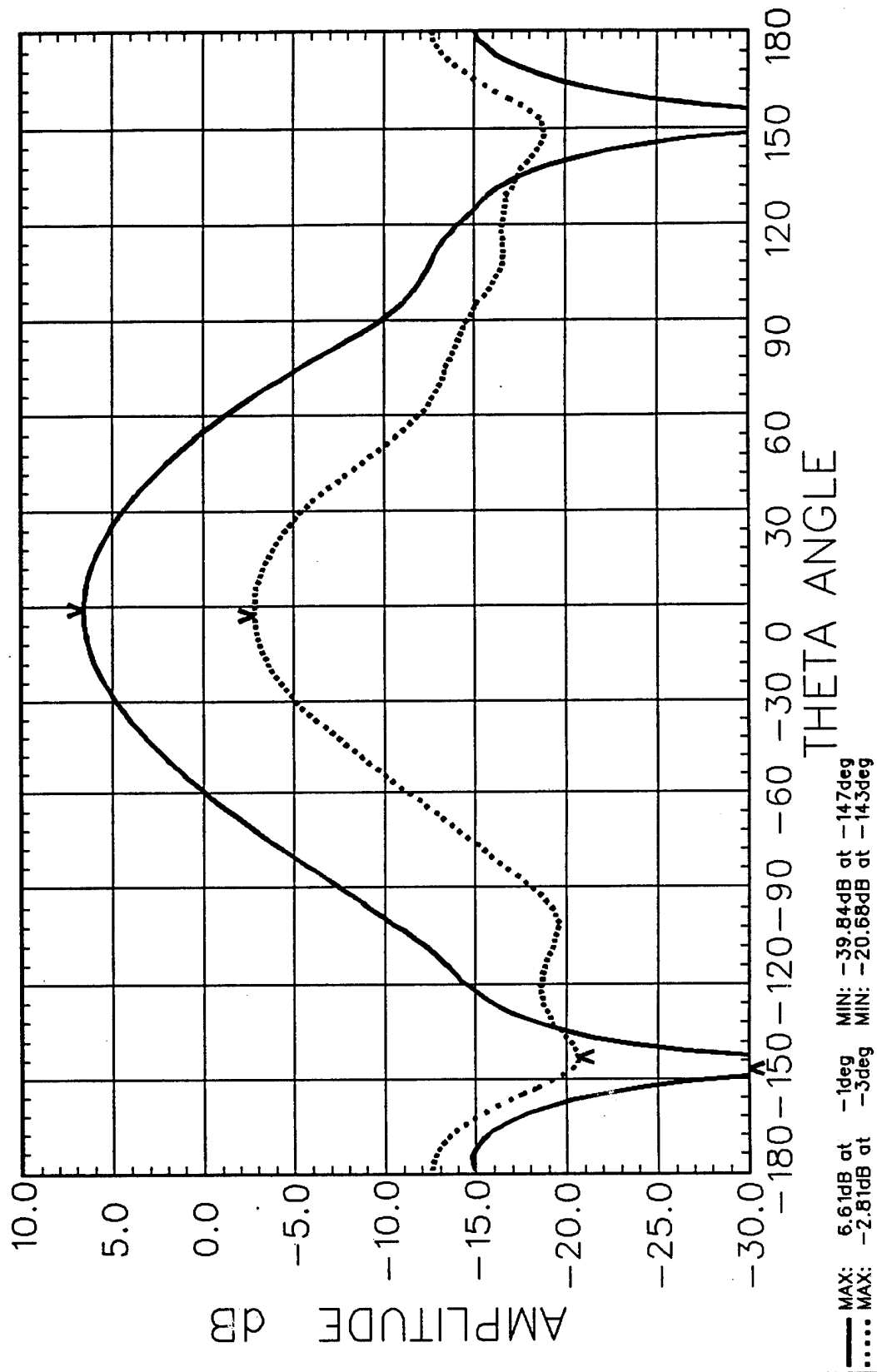
1/2"BELOW GP,5"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6541 HAS 15dB IF ATTEN  
CP6541 HAS 15dB IF ATTEN

260MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
260MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



2) RPL:19 MAY 92  
GP:19:28 OCT 91  
2) RPL:19 MAY 92  
GP:19:28 OCT 91

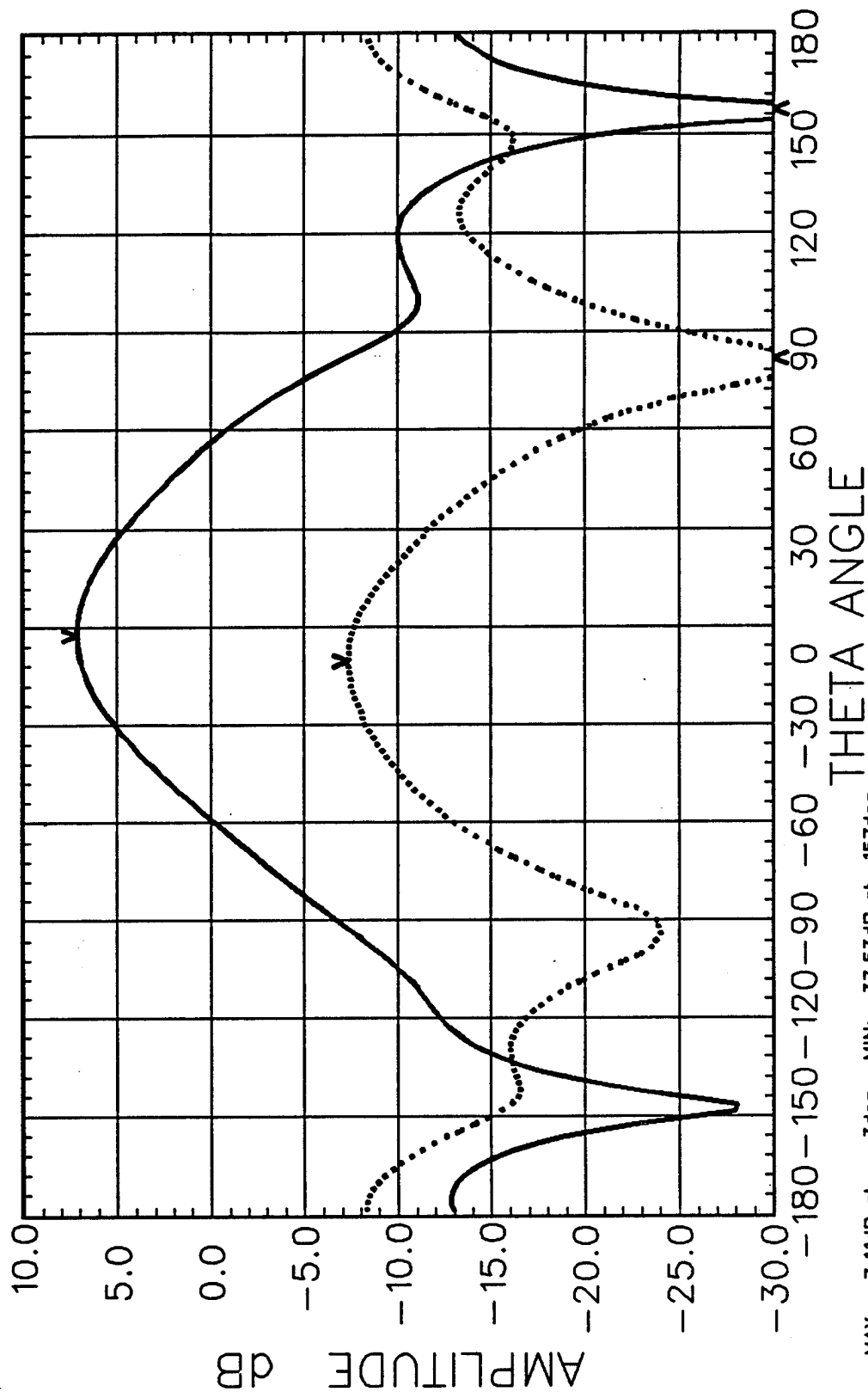
1/2"BELOW GP,5"BORDER  
18 NOV 92

# TAGGANT

BALL AEROSPACE

CP6542 HAS 15dB IF ATTEN  
CP6542 HAS 15dB IF ATTEN

290MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
290MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE



— MAX: 7.11dB at -3deg MIN: -27.53dB at 157deg  
..... MAX: -7.35dB at -11deg MIN: -32.04dB at 81deg

2) RPLDT:19 MAY 92  
CP1EM:28 OCT 91

1/2"BELOW GP,5"BORDER  
18 NOV 92

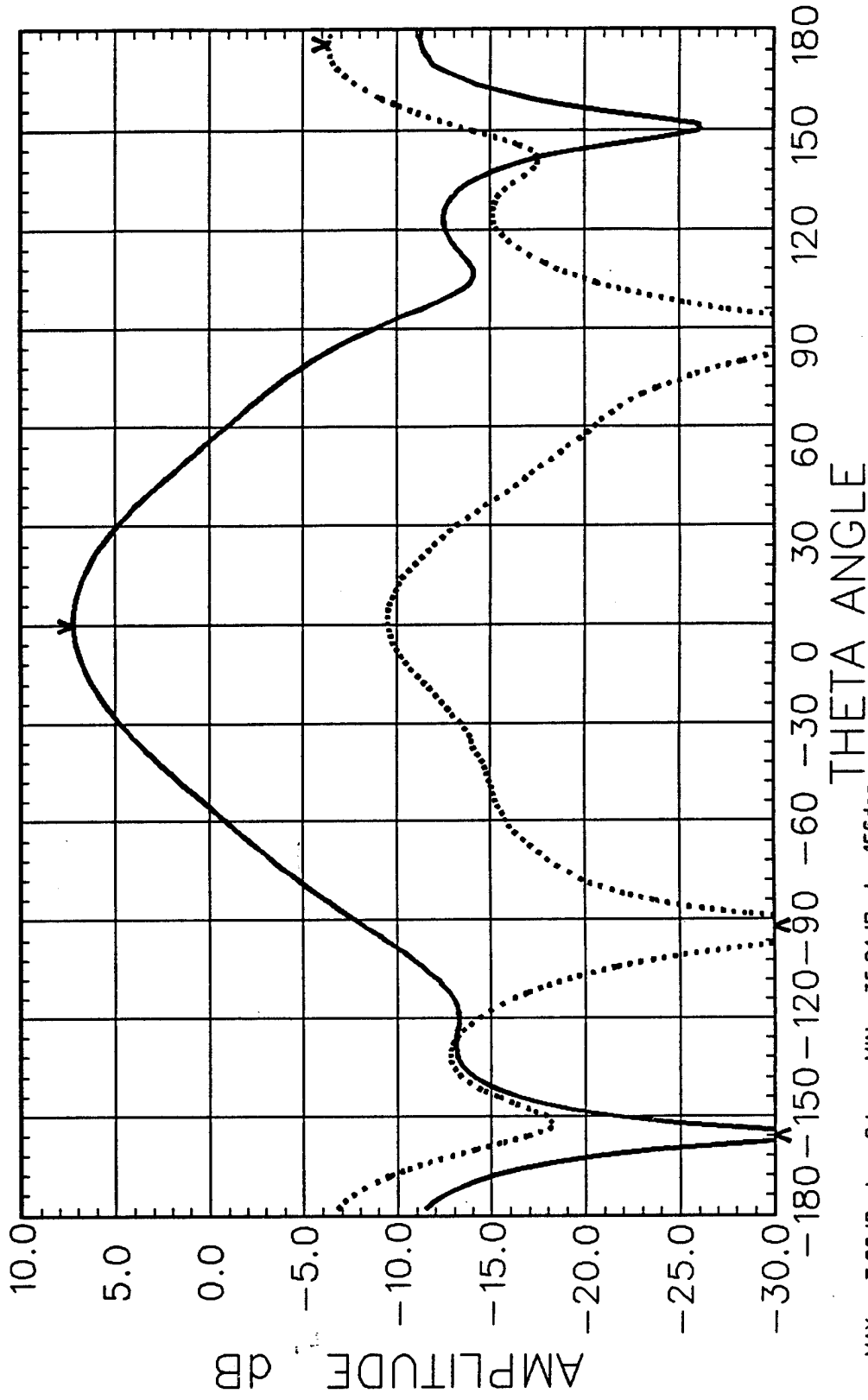
# TAGGANT

BALL AEROSPACE

CP6543 HAS 15dB IF ATTEN  
CP6543 HAS 15dB IF ATTEN

320MHz RHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE  
320MHz LHCP GAIN PHI= 90deg ABSOLUTE AMPLITUDE

— is  
..... is



— MAX: 7.22dB at 0deg MIN: -35.24dB at -156deg  
..... MAX: -6.33dB at 176deg MIN: -39.72dB at -92deg